CONNECTICUT
GREEN BANK SM

# Board of Directors

**Meeting Date**

**January 20, 2023**

# Board of Directors

| | |
|---|---|
| **Lonnie Reed**<br>Chair | **Vickie Hackett**<br>Vice Chair<br>Connecticut Department of Energy and Environmental Protection (DEEP) |
| **Matthew Ranelli**<br>Secretary<br>Partner Shipman & Goodwin | **Sarah Sanders**<br>State Treasurers Office<br>State of Connecticut |
| **Thomas Flynn**<br>Managing Member<br>Coral Drive Partners | **Binu** Chandy<br>Deputy Director<br>DECD |
| **Adrienne Farrar Houel**<br>President and CEO<br>Greater Bridgeport Community Enterprises, Inc. | **Dominick Grant**<br>Director of Investments<br>Dirt Capital Partners |
| **John Harrity**<br>Chair<br>CT Roundtable on Climate and Jobs | **Brenda Watson**<br>Executive Director<br>Operation Fuel |
| **Joanne Wozniak-Brown**<br>Office of Policy and Management (OPM) | **Laura Hoydick**<br>Mayor of Stratford |

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**T** 860.563.0015
**ctgreenbank.com**

CONNECTICUT
**GREEN BANK**

January 13, 2023

Dear Connecticut Green Bank Board of Directors:

We have a regular meeting of the Board of Directors scheduled for **Friday, January 20, from 9:00-11:00 a.m.**

Please take note that this will be an online meeting.

For the agenda, we have the following:

- **Consent Agenda** – we have several items on the consent agenda, including a few items requiring resolutions, including:

    - Meeting Minutes for December 16, 2022
    - Energy Storage Solutions – Non-Residential Project Staff Approvals

    In addition to the items requiring resolution, there are also several documents provided within the materials that are report-outs, including:

    - Progress to Targets through Q2 of FY23
    - FY22 Annual Report

- **Committee Updates and Recommendations** – we have updates and recommendations from several committees, including:

    - **Audit, Compliance, and Governance Committee** – recommendation by the committee to update the internal accounting and control procedures for various reasons (e.g., handling invoice approvals while staff is out of the office, designees for electronic payment processing, President and CEO approval requirements).

    - **Budget, Operations, and Compensation Committee** – recommendation by the committee to approve the proposed revisions to the FY23 targets and budget.

    - **Other Recommendations** – and although not presented or discussed at the Budget, Operations, and Compensation Committee, the review and approval of redline revisions to the FY23 Comprehensive Plan, including revisions to the FY23 targets, budget, and other items.

- **Investment Updates and Recommendations** – recommendations to modify recently approved PosiGen investment, *modification to the Cargill Falls C-PACE investment,* and *authorize the procedures to monetize carbon offsets from the EV recharging infrastructure program*.

- **Financing Programs Updates and Recommendations** – *modify the C-PACE SIR policy to support zero carbon beneficial electrification* and modify commercial solar program.

- **Incentive Programs Updates and Recommendations** – updates on the final decision by PURA within Docket No. 22-08-05 "Annual Energy Storage Solutions Program Review – Year 2".

- **Environmental Infrastructure Updates and Recommendations** – updates on the progress being made with the search for a Director of Environmental Infrastructure, primers, and community engagement.

- **Other Business** – a review of the *final study from the Connecticut Hydrogen Study Task Force* to the Energy & Technology Committee, and a recent Concept Paper submission to the DOE in partnership with Hawaii and Puerto Rico.

Please note, those items *underlined and italicized* above, are materials coming by the close of business on Tuesday, January 17, 2023.

Until next Friday, enjoy the MLK, Jr. holiday weekend ahead.

Sincerely,

Bryan Garcia
President and CEO

# AGENDA

Board of Directors of the
Connecticut Green Bank
75 Charter Oak Avenue
Hartford, CT 06106

Friday, January 20, 2023
9:00 a.m.– 11:00 a.m.

Dial (571) 317-3122
Access Code: 362-523-045

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. Committee Updates and Recommendations – 30 minutes
    a. Audit, Compliance, and Governance Committee
        i. Proposed Revisions of Accounting and Internal Control Procedures
    b. Budget, Operations, and Compensation Committee
        i. Proposed Revisions to FY23 Targets and Budget including “Dream Big” Option*
    c. Other Recommendations
        i. Proposed Revisions to the FY23 Comprehensive Plan
5. Investment Updates and Recommendations – 30 minutes
    a. PosiGen – Final Documentation
    b. Cargill Falls – C-PACE Investment Modification
    c. EV Carbon Credit Pilot Program Authorization
6. Financing Programs Updates and Recommendations – 20 minutes

a. C-PACE SIR Policy Revision
b. Commercial Solar Program – Modification

7. Incentive Programs Updates and Recommendations – 10 minutes

    a. ESS Update of Final Decision in the Year 1 Review.

8. Environmental Infrastructure Programs Updates and Recommendations – 5 minutes

9. Other Business – 10 minutes

    a. Hydrogen Power Study Task Force Update
    b. Other Business

10. Adjourn

Join the meeting online at
https://meet.goto.com/362523045
Or call in using your telephone:
Dial (571) 317-3122
Access Code: 362-523-045

***Next Regular Meeting: Friday, March 17, 2023 from 9:00-11:00 a.m.***
***Colonel Albert Pope Room at the***
***Connecticut Green Bank, 75 Charter Oak Avenue, Hartford***

# RESOLUTIONS

Board of Directors of the
Connecticut Green Bank
75 Charter Oak Avenue
Hartford, CT 06106

Friday, January 20, 2023
9:00 a.m.– 11:00 a.m.

Dial (571) 317-3122
Access Code: 362-523-045

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 Board of Directors for December 16, 2022.

**Resolution #2**

**WHEREAS,** in its June 24, 2022 meeting the Connecticut Green Bank Board of Directors (Board) approved the implementation of an Upfront Incentive Project Approval procedures ("Procedures") for non-residential projects under the Energy Storage Solutions Program (Program) with an estimated upfront incentive payment greater than $500,000 and procedures for less than $500,000;

**WHEREAS**, as part of the approved Procedures, Green Bank staff shall present Program projects via the consent agenda utilizing a standard form Tear Sheet process described in the memorandum to the Board dated June 24, 2022;

**WHEREAS**, in its December 9, 2002 meeting the Board approved updated Procedures to better align with the Program process;

**WHEREAS**, in its July 22, 2022 meeting the Board approved that upfront incentive payments of 13 non-residential projects totaling $16,513,170 and an aggregate capacity of 33.8 MW;

**WHEREAS**, the Program administrators, which include the Green Bank and our utility partners, reassessed the annual peak demand of 4 projects that had previously received Board approval of their estimated upfront incentives;

**WHEREAS**, the reviewed amount of these upfront incentives represents a reduction in the amount of $1,233,060; which is expected to have a positive impact in the Program Ratepayer Impact Measure (RIM);

**WHEREAS**, Green Bank Staff reviewed funding requests for projects with incentives below $500,000, and approved them via Project Approval Forms for a total amount of $1,869,906 and intends to issue Reservation of Fund letters upon Board authorization.

**NOW**, therefore be it:

**RESOLVED**, that the Board hereby approves the reassessed upfront incentives sought by 4 non-residential projects totaling $9,587,980 from their original $10,821,040;

**RESOLVED**, that the Board hereby approves the estimated upfront incentives sought by 1 non-residential projects above $500,000 totaling $598,917 consistent with the approved Procedures;

**RESOLVED**, that the Board hereby approves the estimated upfront incentives sought by 6 non-residential projects individually under $500,000, totaling $1,869,906 consistent with the approved Procedures; and

**RESOLVED**, that the proper Green Bank officers are authorized and empowered to do all other acts and execute and deliver any and all documents and regulatory filings as they shall deem necessary and desirable to effect the above-mentioned incentives consistent with the Procedures.

4. Committee Updates and Recommendations – 30 minutes

    a. Audit, Compliance, and Governance Committee

        i. Proposed Revisions of Accounting and Internal Control Procedures

**Resolution #3**

**WHEREAS**, all Accounting internal control procedures of the Green Bank are being updated to revise the written delegation of authority process and replace specific position titles with generic position titles, with the goal of having the procedures remain up to date if staff titles change

**NOW,** therefore be it:

**RESOLVED**, that the Board of Directors hereby approve the proposed revisions to the Internal Accounting Controls and Procedures as presented herein.

    b. Budget, Operations, and Compensation Committee

        i. Proposed Revisions to FY23 Targets and Budget including “Dream Big” Option*

**Resolution #4**

**WHEREAS**, per Section 5.2.2 of the Bylaws of the Connecticut Green Bank, the Budget, Operations, and Compensation Committee of Board of Directors recommends that the board approve (1) the revised FY2023 Targets and Budget, (2) the addition of the Dream Bigger Strategy and budget, and (3) extend the professional services agreements (PSAs) with Inclusive Prosperity Capital for fiscal year 2023 with the amounts of each PSA not to exceed the applicable approved budget line item;

**NOW**, therefore be it:

**RESOLVED**, that the Board of Directors approves the: (1) the revised FY2023 Targets and Budget, (2) the addition of the Dream Bigger Strategy and budget, and (3) the extension of the professional services agreements (PSAs) with Inclusive Prosperity Capital for fiscal year 2023 with the amounts of each PSA not to exceed the applicable approved budget line item.

c. Other Recommendations

i. Proposed Revisions to the FY23 Comprehensive Plan

**Resolution #5**

**WHEREAS**, on June 24, 2022, the Board of Directors ("Board") of the Connecticut Green Bank ("Green Bank") approved of the annual budgets, targets, and investments for FY 2023.

**WHEREAS**, on July 22, 2022, the Board of the Green Bank reviewed and approved the Comprehensive Plan as presented.

**WHEREAS**, on January 20, 2023 the Board of the Green Bank reviewed and approved the revised FY 2023 Targets and Budget, including the addition of the Dream Bigger Strategy and budget.

**WHEREAS,** per Connecticut General Statutes 16-1245n, the Green Bank must (a) develop a comprehensive plan to foster the growth, development and commercialization of clean energy sources, related enterprises and stimulate demand clean energy and deployment of clean energy sources that serve end use customers in this state, and (b) develop a comprehensive plan to foster the growth, development, commercialization and, where applicable, preservation of environmental infrastructure and related enterprises.

**NOW**, therefore be it:

**RESOLVED**, that Board has reviewed and approved the revised Comprehensive Plan presented to the Board on January 20, 2023.

5. Investment Updates and Recommendations – 30 minutes

a. PosiGen – Final Documentation

**Resolution #6**

**WHEREAS**, the Connecticut Green Bank ("Green Bank") has an existing partnership with

PosiGen, Inc. (together with its affiliates and subsidiaries, “PosiGen”) to support PosiGen in delivering a solar lease (including battery storage) and energy efficiency financing offering to LMI households in Connecticut;

**WHEREAS**, the Green Bank Board of Directors (“Board) previously authorized and later amended the Green Bank’s participation in a back leverage credit facility (the “BL Facility”) collateralized by all of PosiGen’s solar PV system and energy efficiency leases in the United States as part of the company’s strategic growth plan, as well as a facility to finance performance based incentives earned by PosiGen on its solar PV portfolio in Connecticut;

**WHEREAS**, PosiGen repayment performance is satisfactory;

**WHEREAS**, the passage of the federal Inflation Reduction Act of 2022 (the “IRA”) creates a variety of new tax credit value streams that are available in early 2023 but likely to be delayed in terms of monetizable cash flow as explained in the memorandum to the Board dated December 9, 2022 (the “Board Memo”);

**WHEREAS**, PosiGen is currently documenting a new tax equity facility that will incorporate that additional value from IRA and has applied under the Capital Solutions Open RFP program for a revolving loan facility (the “Facility”) to bridge this value to be derived from the IRA provisions being included in the Internal Revenue Code, as further explained in the Board Memo;

**WHEREAS**, Staff has advised the Board that legal counsel has recommended modification of the resolutions in respect of the Facility explained in the December Board Memo to be in conformity with the final documentation for the Facility, and staff agrees with legal counsel and recommends the Board amend and restate the resolutions passed in December 2022 in respect of the Facility; and

**NOW**, therefore be it:

**RESOLVED,** that the Green Bank Board of Directors (the “Board”) amends and restates the resolutions passed during a meeting of the Board held December 16, 2022 as follows:

**RESOLVED,** that the Green Bank may advance up to $6 million in an uncommitted, discretionary financing associated with tax equity cash flows to be remitted as capital contributions by a member of the affiliated SPV directly to the SPV, under a revolving loan facility as further explained in the Board Memo; and

**RESOLVED**, that the Green Bank may make the advances to the existing Borrower for distribution to the SPV, to be repaid through the Managing Member of the SPV to a blocked cash collateral account under the irrevocable control of Green Bank, as further explained in the Board 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.

b. Cargill Falls – C-PACE Investment Modification

**Resolution #7**

**WHEREAS**, pursuant to Conn. Gen. Stat. 16a-40g, the Connecticut Green Bank ("Green Bank") has established a commercial sustainable energy program for Connecticut, known as Commercial Property Assessed Clean Energy ("C-PACE");

**WHEREAS**, the Board of Directors ("Board") of the Green Bank previously approved a construction and term financing, secured by a C-PACE benefit assessment lien, not-to-exceed amount of $8,100,000 (the "Current Lien") to Historic Cargill Falls Mill, LLC ("HCFM"), the property owner of 52 and 58 Pomfret Street, Putnam, Connecticut, to finance the construction of specified clean energy measures (the "Project") in line with the State's Comprehensive Energy Strategy and the Green Bank's Strategic Plan;

**WHEREAS**, the Project includes numerous energy conservation measures that align with the goals and priorities of the Green Bank's multifamily housing program;

**WHEREAS**, Green Bank staff now seeks approval to amend the Current Lien to HCFM to provide non-cash funding (the "Financing Amendment") for the Project, to account for an extension of time to repay principal and interest for the Project as explained in the memorandum in respect of this matter submitted to the Board on January 17, 2023 (the "Board Memo").

**NOW**, therefore be it:

**RESOLVED,** that the President of the Green Bank and any other duly authorized officer of the Green Bank is authorized to execute and deliver the Loan Amendment in a total amount not to exceed the sum of (i) the Current Lien being secured by a C-PACE benefit assessment, plus any and all interest accrued as a result of the principal and interest deferral as explained in the Board Memo with terms and conditions consistent with the Board Memo, and as he or she shall deem to be in the interests of the Green Bank and the ratepayers no later than 180 days from January 20, 2022; and

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

c. EV Carbon Credit Pilot Program Authorization

**Resolution #8**

**WHEREAS,** CGS Sec. 16-245n (as amended by Public Act 21-115) empowers the Connecticut Green Bank to leverage the carbon offset markets to monetize environmental attributes that accelerate the deployment of clean energy;

**WHEREAS,** the Green Bank has led the creation of a methodology with the Verified Carbon Standard to monetize electric vehicle charging activity and is the leader of a consortium that has earned credits under this methodology;

**NOW,** therefore be it:

**RESOLVED,** the Board of Directors of the Connecticut Green Bank direct staff to sell the credits aggregated as part of this project using the aforementioned process and to update the Board as to this process by 2025.

6. Financing Programs Updates and Recommendations – 20 minutes

    a. C-PACE SIR Policy Revision

**Resolution #9**

Staff recommends that the Green Bank Board (the "Board") authorize staff to pursue a statutory change of the SIR policy to make financing certain electrification energy efficiency projects more accessible through C-PACE in accordance with this memorandum and welcomes all feedback

    b. Commercial Solar Program – Modification

**Resolution #10**

**WHEREAS**, the Connecticut Green Bank ("Green Bank") Board of Directors (the "Board") passed resolutions at its March 25, 2020 meeting to approve funding, in a total not-to-exceed amount of $30 million in new money, subject to budget constraints, for the continued development by Green Bank, and financing of development by 3rd parties, of commercial-scale solar PV projects, to be utilized for the following purposes pursuant to market conditions and opportunities:

1. Development capital;
2. Construction financing;
3. Financing one or more 3rd-party ownership platforms, in the form of sponsor equity and/or debt; and
4. Sell solar PPA projects developed by Holdings to third parties.

**WHEREAS**, the Green Bank is uniquely positioned to continue developing a commercial solar project pipeline through local contractors in response to continued demand;

**WHEREAS**, the market for commercial solar financing continues to evolve, as public policy changes create opportunities for financing innovation;

**WHEREAS**, there is still demonstrated need for flexible capital to continue expanding access to financing for commercial-scale customers looking to access solar, while both bolstering project returns for investors and enhancing project savings profiles for customers, including for property owned non-profit and commercial solar PV systems where it is not possible to place a Commercial Property Assessed Clean Energy benefit assessment lien as security, subject to appropriate credit assessment by Green Bank staff of the third party owner as explained in a memorandum submitted to the Green Bank Board of Directors (the "Board") dated January 13, 2023 (the "Board Memo"); and

**WHEREAS**, the Green Bank is implementing a Sustainability Plan that invests in various clean energy projects and products to generate a return to support its sustainability in the coming years.

**NOW**, therefore be it:

**RESOLVED,** that the Board approves financing of third party owned commercial solar PV systems where it is not possible to place a Commercial Property Assessed Clean Energy benefit assessment lien as security, subject to appropriate credit assessment of the third party owner as explained in the Board Memo;

**RESOLVED**, that the President of Green Bank; and any other duly authorized officer of Green Bank, is authorized to execute and deliver, any contract or other legal instrument necessary to continue to develop and finance commercial projects on such terms and conditions as are materially consistent with the Board Memo; and

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

7. Incentive Programs Updates and Recommendations – 10 minutes

    a. ESS Update of Final Decision in the Year 1 Review.

8. Environmental Infrastructure Programs Updates and Recommendations – 5 minutes

9. Other Business – 10 minutes

    a. Hydrogen Power Study Task Force Update

10. Adjourn

Join the meeting online at
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***Next Regular Meeting: Friday, March 17, 2023 from 9:00-11:00 a.m.***
***Colonel Albert Pope 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

# Board of Directors Meeting

January 20, 2023

**Online Meeting**

# Board of Directors

## Agenda Item #1

## Call to Order

# Board of Directors

## Agenda Item #2

## Public Comments

# Board of Directors

## Agenda Item #3

## Consent Agenda

# Consent Agenda

## Resolutions #1 and #2

1. **Meeting Minutes** – approve meeting minutes of December 16, 2022
2. **Energy Storage Solutions** – non-residential approvals of upfront incentives more than $500,000

- **Progress to Targets Quarterly Report** – through Q2 of FY23
- **Annual Report** – for FY22

# Board of Directors

## Agenda Item #6a

## Financing Programs Updates and Recommendations

## C-PACE SIR Policy Revision

# Savings-to-Investment Ratio (SIR)

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**C-PACE Statute- C.G.S.A. 16a-40g**

**Commercial sustainable energy program**

"…shall adopt standards to ensure that the energy cost savings of the energy improvements over the useful life of such improvements exceed the costs of such improvements…"

$$\frac{\textbf{Savings (S)}= \$ \text{ savings over the life of equipment installed}}{\textbf{Investment (I)}= \$ \text{ amount to be financed, inclusive of project costs, closing fees \& interest}} > 1$$

# SIR Issues

- Several HVAC projects that include high-efficiency heat pumps, central AC, or chillers have not passed SIR because the energy cost savings over the life of the projects do not exceed the investment. **The implementation of these projects aligns with CT's decarbonization goals and strategies.**
- EnergizeCT uses a different approach to determine incentive eligibility (incremental cost instead of total cost for these measures). Two different calculated approaches to energy savings and eligibility can lead to **confusion/uncertainty for contractors as they try to include C-PACE financing into a proposal discussion with a property owner**

# SIR Issues
## Examples

**West Lane Inn** (partially financed)

- Project Scope: VRF heat pumps replacing fossil fuel heating
- Project cost: $110,500
- Incentive: $5,288
- Amount financed: $98,841
- Reason only partially financed: Even with Eversource incentive, the savings from replacing of an inefficient oil-fired boiler did not exceed the investment

**Tabernacle Church** (70% utility incentive)

- Project Scope: VRF heat pumps replacing fossil fuel heating
- Project cost: $159,600
- Incentive: $111,720
- Amount financed: $49,316
- Reason project penciled: Result of a higher-than-typical **special** 'early retirement' incentive from Eversource

**Greenwich YMCA** (not financed): A $1.2M higher-than-code efficiency chiller project replacing a low-efficiency chiller resulted in an SIR of 0.35, with an owner equity contribution of $825,000 (no utility incentive). Although the Borrower was interested in the project (despite the lower cash flow) due to its efficiency and associated non-energy benefits, this project could not proceed.

# Policy Revision Suggestion

Continue to require the SIR calculation itself, but **remove the necessity for the SIR to be greater than 1** for technologies identified as **high-efficiency electrification technologies with no fossil fuels**.

A few examples of high-efficiency electrification technologies are as follows:

- Heat pumps (above code efficiency)
- Heat pump water heaters
- Fuel switching from fossil fuel heating/cooling to high-efficiency electric heating/cooling (such as absorption chillers to electric chillers or gas-fired RTUs to heat pumps)
- Replacing fossil fuel process equipment with electric equipment (such as propane to electric forklifts)

# Process Revisions

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## We will continue to require:

- Continue to require the SIR evaluation (energy audit completed by the contractor, followed by 3rd-party review of the savings)
- As a capital provider, CGB will continue to underwriting requirements will remain the same (Loan-to-Value, Lien-to-Value and Debt Service Coverage Ratio)
- All other C-PACE programmatic requirements, including lender consent, will remain as they are

***New Requirement***

**Require the Borrower to review SIR calculation & sign a document stating they understand they are financing a project with an SIR<1**

# Benefits/Challenges

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**Benefits**

- Incentivizes property owners to explore electrification measures through *low-cost, long-term financing*
- More electrification projects in the state, consistent with the *state's public policies on reducing greenhouse gas emissions*
- Allows Borrowers to make decisions based on *other positive project aspects besides cash flow*
- Increase the # of financeable projects through C-PACE= *more closed projects for both CGB & 3rd party CP*

**Challenges**

- Lender consent without positive cash flow
- Savings from projects will not be greater than the C-PACE repayments, potentially increasing the risk of default
- Financial underwriting for projects without the added benefit of positive cash flow
- Creates an extra 'step' in the process for Borrower to review the cash flow analysis and understands how the project is projected to perform, from a financial perspective.

# Questions/Discussion?

# Board of Directors

## Agenda Item #6b

## Financing Programs Updates and Recommendations

## Commercial Solar Program – Modification

# Commercial Solar Program – Modification
## Non C-PACE secured financing

- **Overview of Commercial Solar Program today:**

  $30M funding available for:

  - Development capital;
  - Construction financing;
  - Financing one or more 3rd-party ownership platforms, in the form of sponsor equity and/or debt; and
  - Selling solar projects developed by CEFIA Holdings LLC to third parties.

- **Request for Modification**
  - Without changing available funding, request to add new financing option
  - Non C-PACE secured financing for entities that are unable to access C-PACE secured financing, e.g., condominiums associations, municipalities, entities with mortgage holders that will not subordinate to C-PACE lien

# Commercial Solar Program – Modification
## Non C-PACE secured financing

- **Reason for Modification Request**
  - Market *need*: some entities cannot access C-PACE financing, but still want to finance and own solar PV systems (active transaction under consideration)
  - Market *opportunity*:
    - This is an underserved sector of the commercial solar market
    - CT policy environment allows for assignment of solar tariff revenue to CGB as financing provider, decreasing repayment risk
- **Approval of these Transactions**
  - < $0.5 million: Staff level approval;
  - Between $0.5 million and $2.5 million: Deployment Committee; and
  - > $2.5 million: Board.

# Resolution #10

**NOW**, therefore be it:

**RESOLVED,** that the Board approves financing of third party owned commercial solar PV systems where it is not possible to place a Commercial Property Assessed Clean Energy benefit assessment lien as security, subject to appropriate credit assessment of the third party owner as explained in the Board Memo;

**RESOLVED**, that the President of Green Bank; and any other duly authorized officer of Green Bank, is authorized to execute and deliver, any contract or other legal instrument necessary to continue to develop and finance commercial projects on such terms and conditions as are materially consistent with the Board Memo; and

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

# Board of Directors

## Agenda Item #4ai

## Audit, Compliance, and Governance Committee

## Proposed Revisions of Accounting and Internal Control Procedures

# Update of Accounting Internal Control Procedures – Overview

- Form the basis for safeguarding assets and ensuring disbursements are reviewed/approved by appropriate levels.
- Part of the overall system of internal controls that ensure financial transactions are recorded timely and accurately.
- Reviewed for material weaknesses during the annual financial audit.
- Procedures include:

  CGB 101 – Purchasing and Accounts Payable
  CGB 102 – Consulting and Advisory Services
  CGB 103 – Credit Cards
  CGB 104 – Mobile Devices
  CGB 105 – Fixed Assets and Depreciation

# Update of Accounting Internal Control Procedures – Proposed Revisions

- CGB 101 through 105
  - ✓ Change position specific titles to be generic
- CGB 101 Purchasing and Accounts Payable updates
  - ✓ Invoice approvals while staff is out of the office
  - ✓ Senior member of the Accounting department as designee for electronic payments (updated per recommendation from external auditor)
  - ✓ Remove President & CEO requirement to approve intercompany cash transfers
  - ✓ Remove President & CEO requirement reapprove invoices approved by a designee

# Resolution #3

**NOW**, therefore be it:

**RESOLVED**, that the Board of Directors hereby approve the proposed revisions to the Internal Accounting Controls and Procedures as presented herein.

# Board of Directors

## Agenda Item #4bi

## Budget, Operations, and Compensation Committee

## Proposed Revisions to FY23 Targets and Budget including “Dream Big” Option

# Comprehensive Plan
# FY 2023 Incentive Programs Targets – Proposed Revisions

| Segment | Program | Targets | | | |
|---|---|---|---|---|---|
| | | Number of Projects | Total Capital Deployed | | Capacity Installed/ Nameplate Capacity |
| Incentive Programs | *Residential Storage Incentives Total* | 350 | 14,875,000 | | 4.7 |
| | *C&I Storage Incentives Total* | 30 | 67,500,000 | | 45.0 |
| | **Total Battery Storage** | **380** | **$82,375,000** | | **49.7** |
| | **Total Smart-E** | **960** | **$14,994,623** | | **0.2** |
| | **Incentive Programs Total** | **1,340** | **$97,369,623** | | **49.9** |

To support **1,340** ~~**1,460**~~ **projects** attracting investment of **$97,369,623** ~~**$34,994,623**~~ to deploy at least **49.9 MW** ~~**8 MW**~~ of clean energy.

# Comprehensive Plan
# FY 2022 Financing Programs Targets – Proposed Revisions

| Segment | Product | Targets | | | |
|---|---|---|---|---|---|
| | | Number of Projects | Total Capital Deployed | CGB Capital Deployed | Capacity Installed |
| Financing Programs | CPACE | 23 | $31,000,000 | $7,000,000 | 0.0 |
| | PPA/RoofLeases | 19 | $13,710,000 | $2,700,000 | 7.6 |
| | SBEA | 839 | $18,600,000 | $3,720,000 | |
| | Multi-Family Pre-Dev | 0 | $0 | | 0.0 |
| | Multi-Family Term | 6 | $1,380,000 | $0 | 0.6 |
| | Multi-Family Health and Safety Total | 1 | $892,500 | | |
| | Transportation | 0 | 0 | | 0 |
| | Strategic Investments | 0 | $0 | | 0.0 |
| | Financing Programs Total | 882 | $ 64,202,500 | $ 13,420,000 | 7.6 |

To support **882 <u>projects</u>** attracting investment of **$64,202,500** to deploy at least **<u>7.6 MW</u>** of clean energy. These targets have not changed.

# Budget - Revenue Changes

| | Fiscal Year Jun 30 2023 | | |
|---|---|---|---|
| | Recast Budget | FY23 Original Budget | Variance |
| **Revenue** | | | |
| Operating Income | | | |
| Utility Customer Assessments | 24,737,413 | 24,408,800 | 328,613 {A} |
| RGGI Auction Proceeds-Renewables | 8,910,288 | 10,884,140 | (1,973,852) {B} |
| CPACE Closing Fees | 123,000 | 123,000 | 0 |
| REC Sales | 13,917,136 | 13,917,136 | 0 |
| Grant Income-Federal Programs | 40,000 | 40,000 | 0 |
| PPA Income | 465,000 | 465,000 | 0 |
| LREC/ZREC Income | 325,000 | 325,000 | 0 |
| Total Operating Income | 48,517,837 | 50,163,076 | (1,645,239) |
| Interest Income | 6,158,000 | 6,158,000 | 0 |
| Interest Income, Capitalized | 48,000 | 48,000 | 0 |
| Other Income | 404,535 | 404,535 | 0 |
| **Total Revenue** | **$ 55,128,372** | **$ 56,773,611** | **(1,645,239)** |

# Budget - Expense Changes

| | | | |
|---|---|---|---|
| **Operating Expenses** | | | |
| Compensation and Benefits | | | |
| Employee Compensation | 6,345,292 | 6,279,476 | 65,816 {C} |
| Employee Benefits | 5,618,380 | 5,568,865 | 49,515 {C} |
| Total Compensation and Benefits | 11,963,672 | 11,848,341 | 115,331 {C} |
| Program Development & Administration | 4,828,766 | 4,623,266 | 205,500 {D} |
| Program Administration-IPC Fee | 1,366,220 | 1,366,220 | 0 |
| Lease Origination Services | 4,000 | 4,000 | 0 |
| Marketing Expense | 1,750,165 | 1,750,165 | 0 |
| E M & V | 1,048,000 | 963,000 | 85,000 {E} |
| Research and Development | 720,000 | 200,000 | 520,000 {F} |
| Consulting and Professional Fees | | | |
| Consulting/Advisory Fees | 975,700 | 1,020,700 | (45,000) {G} |
| Accounting and Auditing Fees | 318,350 | 318,350 | 0 |
| Legal Fees & Related Expenses | 242,000 | 242,000 | 0 |
| Total Consulting and Professional Fees | 1,536,050 | 1,581,050 | (45,000) |
| Rent and Location Related Expenses | | | |
| Rent/Utilities/Maintenance | 308,716 | 308,716 | 0 |
| Telephone/Communication | 56,400 | 56,400 | 0 |
| Depreciation & Amortization | 673,314 | 673,314 | 0 |
| Total-Rent and Location Related Expenses | 1,038,430 | 1,038,430 | 0 |
| Office, Computer & Other Expenses | 1,780,265 | 1,780,265 | 0 |
| **Total Operating Expenses** | **26,035,567** | **25,154,737** | **880,831** |
| | | | |
| **Program Incentives and Grants** | | | |
| Financial Incentives-CGB Grants | 5,185,000 | 5,185,000 | 0 |
| Program Expenditures-Federal Grants | 40,000 | 40,000 | 0 |
| EPBB/PBI/HOPBI Incentives | 9,396,958 | 14,250,000 | (4,853,042) {H} |
| Battery Storage Incentives | 1,657,012 | 2,430,284 | (773,272) {I} |
| **Total Program Incentives and Grants** | **$ 16,278,970** | **$ 21,905,284** | **(5,626,314)** |
| | | | |
| **Operating Income/(Loss)** | **$ 12,813,835** | **$ 9,713,590** | **3,100,244** |
| | | | |
| **Non-Operating Expenses** | | | |
| Interest Expense | 2,554,641 | 2,554,641 | 0 |
| Provision for Loan Loss | 2,333,000 | 2,333,000 | 0 |
| Interest Rate Buydowns-ARRA | 600,000 | 600,000 | 0 |
| **Total Non-Operating Expenses** | **$ 5,487,641** | **$ 5,487,641** | **0** |
| | | | |
| **Net Revenues Over (Under) Expenses** | **7,326,194** | **4,225,950** | **3,100,244** |

# Budget – Dream Big Option

- We have the opportunity to lean into the market and facilitate projects enabled by the IRA incentives to achieve a greater level of deployment
- Staff focused around 5 areas and what do we need to do with them to seize this opportunity:
  - Product
  - Policy
  - Promotion
  - People
  - Place

**Budget**

- 5 Additional Staff focused on bringing in projects (3 financing programs, 1 outreach, 1 data science/marketing)
- $50K for additional marketing assets (how do we reach consumers with to show the combined value of incentives and financing?)
- $50K for holding Green Bank events bringing the Green Bank to people (pop-up's and office hours)

# IPC PSA Amendments

Request to extend the professional services agreements (PSAs) with Inclusive Prosperity Capital for fiscal year 2023 with the amounts of each PSA not to exceed the applicable approved budget line item:

| | Previous | Increase | New Amount |
|---|---|---|---|
| **Smart-E** | $1,236,648 | $317,022 | $1,553,670 |
| **Multifamily** | $1,474,878 | $307,615 | $1,782,493 |
| **Commercial** | $1,473,656 | $741,582 | $2,215,238 |

# Resolution #4

**NOW**, therefore be it:

**RESOLVED**, that the Board of Directors approves the: (1) the revised FY2023 Targets and Budget, (2) the addition of the Dream Bigger Strategy and budget, and (3) the extension of the professional services agreements (PSAs) with Inclusive Prosperity Capital for fiscal year 2023 with the amounts of each PSA not to exceed the applicable approved budget line item.

# Board of Directors

## Agenda Item #4ci

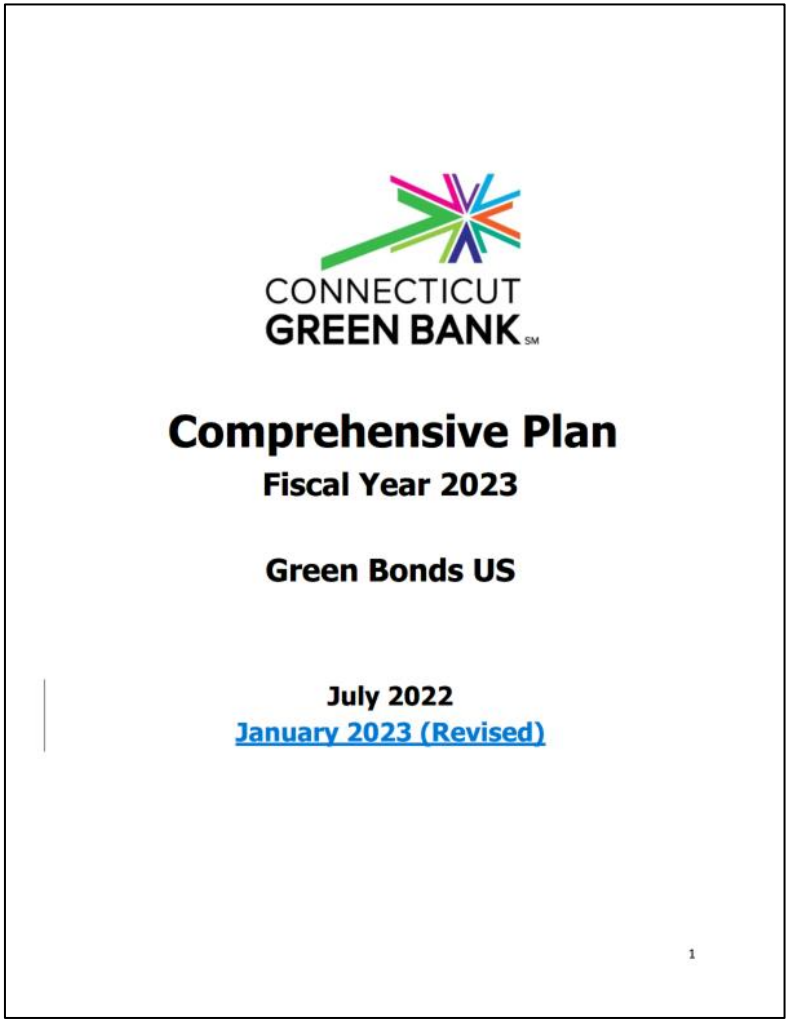
## Budget, Operations, and Compensation Committee

## Other Recommendations

## Proposed Revisions to FY23 Comprehensive Plan

# FY23 Comprehensive Plan
## Proposed Revisions

- **Non-Substantive Edits** – including:
  - Page numbers
  - Footnotes
  - Links and New Reports (e.g., FY22 annual reports)
  - Acronyms
- **Substantive Edits** – including:
  - Executive Summary – consistent with "Dream Big" strategy (e.g., IRA, GHGRF)
  - Updates (e.g., RSIP as of June 30, 2022)
  - Targets and Budget – Revised
  - Task – removal of "waste and recycling" primer from FY23 to FY24
  - Inclusion of "Battery Recycling" under Research and Product Development



# Resolution #5

**NOW**, therefore be it:

**RESOLVED**, that Board has reviewed and approved the revised Comprehensive Plan presented to the Board on January 20, 2023.

# Board of Directors

## Agenda Item #5a

## Investment Updates and Recommendations

## PosiGen – Final Documentation

# Capital Solutions Request – PosiGen

## Tax Equity & IRA Tax Credit Adder Bridge Facility

- **Board approved a Capital Solutions request for a $6 million 2-year senior secured facility to "bridge" payments from tax equity (e.g., the M&T facility) and tax credit "adders".**
- As counsel developed the final documentation, it was determined that the December resolution approved by the Board requires adjustment to bring the approval in line with the final agreed structure.
- The request here is for the Board to approve the following resolutions so the Green Bank can proceed to closing with PosiGen.

**RESOLVED,** that the Green Bank may advance up to $6 million in ~~1st lien~~ an uncommitted, discretionary financing associated with tax equity cash flows, to be remitted as capital contributions by a member of the affiliated SPV directly to the SPV, under a revolving loan facility, under a revolving loan facility as further explained in the Board Memo; and

**RESOLVED**, that the Green Bank may make the advances to the existing Borrower for distribution to the SPV, to be repaid through the Managing Member of the SPV to a blocked cash collateral account under the irrevocable control of Green Bank, as further explained in the Board Memo; and

# Resolution #6

**NOW**, therefore be it:

**RESOLVED,** that the Green Bank Board of Directors (the "Board") amends and restates the resolutions passed during a meeting of the Board held December 16, 2022 as follows:

**RESOLVED,** that the Green Bank may advance up to $6 million in an uncommitted, discretionary financing associated with tax equity cash flows to be remitted as capital contributions by a member of the affiliated SPV directly to the SPV, under a revolving loan facility as further explained in the Board Memo; and

**RESOLVED**, that the Green Bank may make the advances to the existing Borrower for distribution to the SPV, to be repaid through the Managing Member of the SPV to a blocked cash collateral account under the irrevocable control of Green Bank, as further explained in the Board 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.

# Board of Directors

## Agenda Item #5b

## Investment Updates and Recommendations

## Cargill Falls– C-PACE Investment Modification

# Santa's Visit to Cargill Falls

CONNECTICUT GREEN BANK

- FERC required weeds to be removed at Cargill Falls, which needed specialized equipment that the contractors at the site did not have.
- The contractors were able to negotiate with the town of Putnam to remove the weeds and, in return, they helped to put up Santa (and his reindeer) over the river.

# Historic Cargill Falls Mill Project Update

- **Project Background:** Putnam CT mill redevelopment to mixed-use residential (82 units – incl 34 DOH low income / restricted) and commercial space, 2 hydro electric turbines (~900 kW total capacity fed by the Quinebaug River) and energy conservation measures
- **Real Estate Update**:
  - **Residential** occupancy at 100%; 45 wait list; 6% vacancy. $~1.4M in rental income.
  - Annual income from **Commercial** Leases: ~$110k
  - 12/14/22 - Lead concern in a unit. That unit tested by NDDH, abatement plan completed and presented to NDDH. NDDH inspected 23 units, awaiting results. Ownership undertaking a more comprehensive plan for testing and abatement/remediation (if necessary)
- **Hydro Update:**
  - Delays due to work approved by DOT and difficulties in obtaining equipment breakdown insurance
  - One turbine to begin testing this week
- Expected revenue/savings from hydro: $130k energy savings, $270k ZREC revenue and $61k in excess generation sold to grid

# Historic Cargill Falls Mill Payment Modification

- Current CPACE Structure:
  - **First Benefit Assessment Lien:** $8,811,116.72 ($7.1M loan + $1.7M capitalized interest). Repayment start date of July 1, 2022
    - 35 year term, 5% interest rate
    - Supplemental Interest: 0.95% interest from available cash flow
  - **Second Benefit Assessment Lien**: $1,000,000. Repayment start date of January 1, 2022
    - 10 year term; 5% interest
    - A 3-1/2 year interest only period ending 1/1/2025
- **Modification**:
  - 80% of P&I payments associated with First Lien for 2023 and 2024 to be added to the Second Benefit Assessment Lien; the rest paid by Project.
  - Extend the term of Second Benefit Assessment Lien from 10 to 15 years

| Balance Outstanding | Original (1/1/25) | Proposed Modification (1/1/25) | Current 1/1/23 |
|---|---|---|---|
| First Benefit Assessment Lien | $8,301,744 | $8,301,744 | $8,500,613 |
| Second Benefit Assessment Lien | $1,255,038 | $2,098,539 | $1,255,038 |

# Resolution #7

**NOW**, therefore be it:

**RESOLVED,** that the President of the Green Bank and any other duly authorized officer of the Green Bank is authorized to execute and deliver the Loan Amendment in a total amount not to exceed the sum of (i) the Current Lien being secured by a C-PACE benefit assessment, plus any and all interest accrued as a result of the principal and interest deferral as explained in the Board Memo with terms and conditions consistent with the Board Memo, and as he or she shall deem to be in the interests of the Green Bank and the ratepayers no later than 180 days from January 20, 2022; and

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

# Board of Directors

## Agenda Item #5c

## Investment Updates and Recommendations

## EV Carbon Credit Pilot Program Authorization

# EV Carbon Offsets
## Program

- **Methodology** – CGB and partners, with the guidance from the CNBN, developed and received approval for a methodology to create carbon credits using the Verified Carbon Standard from EV charging activity
- **Initial Filing** – In 2021, the Green Bank and 13 partners filed our charging activity to receive credits for activity from 2016-2020. The Green Bank acts as the aggregator and facilitator for the group.
- **Credits** – Credits were minted (issued) in October 2022 by Verra and now we are seeking to monetize these credits

# EV Carbon Offsets
## Sales

Process

1. Verify quantity
2. Consult Market and obtain at least 3 data points for price
3. Review and approval from CGB Officers, Head of Finance, and Head of Operations of the trades
4. Memorialize the Transaction

Review Process by 2025

# Resolution #8

**NOW,** therefore be it:

**RESOLVED,** the Board of Directors of the Connecticut Green Bank direct staff to sell the credits aggregated as part of this project using the aforementioned process and to update the Board as to this process by 2025.

# Board of Directors

## Agenda Item #7a

## Incentive Programs Updates and Recommendations

## ESS Update of Final Decision in Year 2 Review

# RRES Docket

## Year-2 Final Decision Review

| ISSUE | ANALYSIS AND DECISION |
|---|---|
| **C. Updated Incentive Levels** | *"Accordingly, the Authority authorizes the Program Administrators to prohibit from FCM participation BTM projects submitted to the ESS Program beginning January 1, 2023."*<br><br>*"… the Authority consequently directs the CGB to conditionally replace FCM participation with a new 50% upfront incentive adder for residential projects and a 25% upfront incentive adder for commercial and industrial customers among the most valuable customer groups that would otherwise have been eligible for FCM participation, including eligible customers located on the grid edge, eligible critical facilities, eligible small businesses, and eligible customers replacing a fossil fuel generator."* |

# RRES Docket

## Year-2 Final Decision Review

CONNECTICUT GREEN BANK

| ISSUE | ANALYSIS AND DECISION |
|---|---|
| **D. Low-Income and Underserved Communities Upfront Incentive** | *"… Consequently, the Authority approves the CGB proposal to increase the low-income and underserved community adders in incentive steps two and three to match the adder in incentive step one."* |

**Table 4: CGB Residential Customer Upfront Incentive (2022-2024)**

| Incentive Step | Estimated No. of Participants | Capacity Block (MW) | Standard ($/kWh)* | Underserved ($/kWh)* | Low-Income ($/kWh)* | Average Upfront Incentive per System |
|---|---|---|---|---|---|---|
| 1 | 2,000 | 10.0 | $200 | $300 | $400 | $3,375 |
| 2 | 3,000 | 15.0 | $170 | $300 | $400 | $3,132 |
| 3 | 5,000 | 25.0 | $130 | $300 | $400 | $2,808 |
| **Total** | **10,000** | **50.0** | | | | |

*Upfront incentives are defined based on rated energy capacity (kWh)

# RRES Docket

## Year-2 Final Decision Review

| ISSUE | ANALYSIS AND DECISION |
|---|---|
| **E. Upfront Incentive Cap** | *"… a lower upfront incentive limit would be more effective in distributing storage resources throughout the state. The Authority therefore directs the Program Administrators to limit the upfront incentive to 150% of customer peak load or to 2 MW, whichever is greater, so that the pros and cons of an upfront incentive cap can be appropriately balanced."* |

# RRES Docket

## Year-2 Final Decision Review

| ISSUE | ANALYSIS AND DECISION |
|---|---|
| **I. Active Dispatch-Only Program Participation** | *"… the Authority approves the CGB recommendation to allow active dispatch only participation in the Program for all projects, including new residential applications, beginning January 1."*<br><br>*"… the Authority directs the Program Administrators to limit project participation in active only dispatch to projects which are 5 MW of less."*<br><br>*"… Additionally, a smaller size limit will more thoroughly address any concerns that larger systems would disproportionately benefit from the Program and, ultimately, use a large sum of ratepayer money."* |

# RRES Docket

## Year-2 Final Decision Review

CONNECTICUT GREEN BANK

| ISSUE | ANALYSIS AND DECISION |
|---|---|
| **M. Vacated Commercial Project Capacity** | *"The Authority further notes that the Program Administrators have the authority to open Tranche 2 for commercial and industrial projects at their discretion, once the preceding Tranche is at full capacity, in order to achieve the third Program Objective, to foster the sustained, orderly development of a state-based electric energy storage industry."* |

| CUSTOMER CLASS | 2022-2024 | 2025-2027 | 2028-2030 | TOTAL |
|---|---|---|---|---|
| Residential | 50 MW | 100 MW | 140 MW | 290 MW |
| Commercial & Industrial | 50 MW | 100 MW | 140 MW | 290 MW |
| **Total** | **100 MW** | **200 MW** | **280 MW** | **580 MW** |

# RRES Docket

## Year-2 Final Decision Review

| ISSUE | ANALYSIS AND DECISION |
|---|---|
| **N. RRES Annual Review Updates** | *"… the Authority clarifies that, consistent with the Decision issued June 8, 2022 in Docket No. 21-08-02, Annual Residential Renewable Energy Tariff Program Review and Rate Setting, and consistent with the Decision issued November 2, 2022 in Docket No. 22-08-02, Annual Residential Renewable Energy Solutions Program Review- Year 2, the definition and eligibility criteria for Multifamily Affordable Housing to be treated as residential customers in the RRES Program will also be applicable to the ESS Program."* |

| Incentive Step | Estimated No. of Participants | Capacity Block (MW) | Standard ($/kWh)* | Underserved ($/kWh)* | Low-Income ($/kWh)* |
|---|---|---|---|---|---|
| 1 | 2,000 | 10.0 | $200 | $300 | $400 |
| 2 | 3,000 | 15.0 | $170 | $300 | $400 |
| 3 | 5,000 | 25.0 | $130 | $300 | $400 |
| **Total** | **10,000** | **50.0** | | | |

# Board of Directors

## Agenda Item #8

## Environmental Infrastructure Programs Updates and Recommendations

# Environmental Infrastructure

## Updates

- **Director of Environmental Infrastructure** – search making steady progress with final in-person interviews tentatively scheduled for mid-February
- **Primers** – wrapping up primers on water and environmental markets and expect to finalize by Earth Day 2023
- **Communities LEAP** – continuing to learn from and support Bridgeport Regional Energy Partnership for community engagement

# Board of Directors

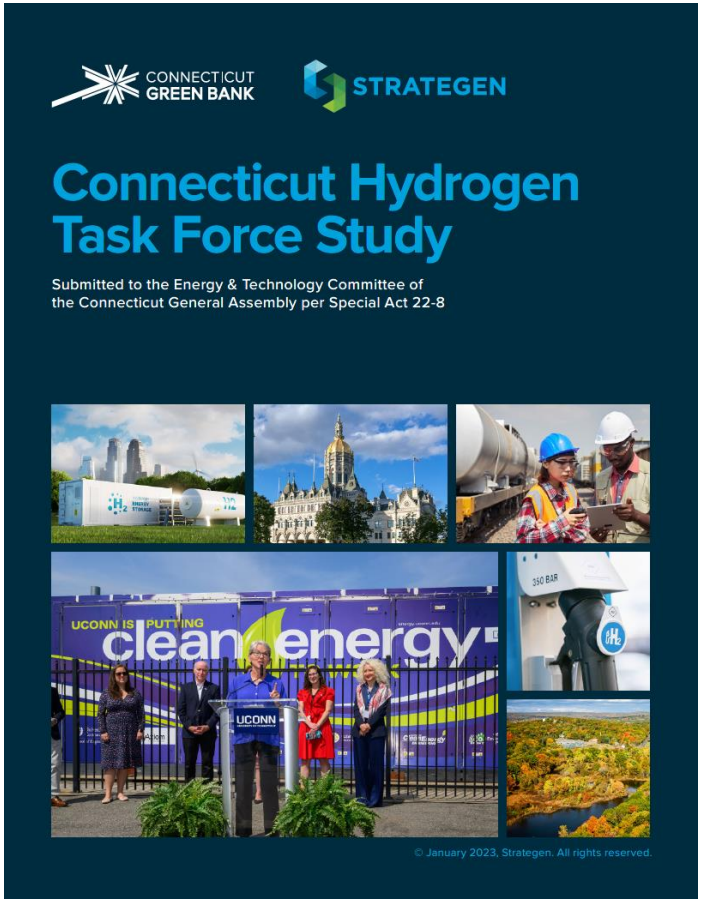
## Agenda Item #9a

## Other Business

## Hydrogen Power Study Task Force Update

# Hydrogen Task Force
## Process

- **<u>Excellent Engagement from Participants</u>** – Ex-Officios, Appointees, Designees & Consultant provided a high level of knowledge
- **<u>Complementary to Other Efforts</u>** – Comprehensive Energy Strategy (DEEP) & regional Hydrogen Hub (IIJA)
- **<u>Economic Development Opportunity</u>** – Connecticut is a hydrogen leader (fuel cell & electrolysis research and manufacturing), this is an opportunity to lead



# Hydrogen Task Force

## Next Steps

- **Delivery of Report** – Sent report to Energy & Technology Committee on 1/15. Includes recommendations for actions to be taken by Legislature, State Agencies, UConn, and industry
- **Concept Committee Bill** – Supporting Committee chairs with legislative vehicle for Task Force's recommendations
- **Presenting to Energy & Technology Committee** – With support from consultant and Task Force members, expose Committee to diverse perspectives

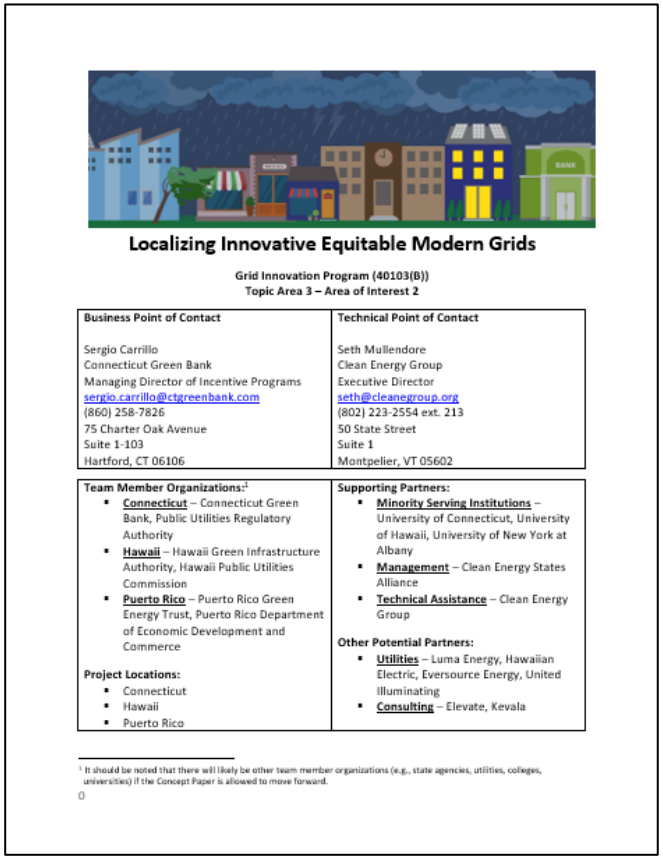
# Board of Directors

## Agenda Item #9b

## Other Business

# Federal Government

## Concept Paper and Transparency





**Localizing Innovative Equitable Modern Grids**

**Grid Innovation Program (40103(B))**
**Topic Area 3 – Area of Interest 2**

| Business Point of Contact | Technical Point of Contact |
|---|---|
| Sergio Carrillo<br>Connecticut Green Bank<br>Managing Director of Incentive Programs<br>sergio.carrillo@ctgreenbank.com<br>(860) 258-7826<br>75 Charter Oak Avenue<br>Suite 1-103<br>Hartford, CT 06106 | Seth Mullendore<br>Clean Energy Group<br>Executive Director<br>seth@cleanegroup.org<br>(802) 223-2554 ext. 213<br>50 State Street<br>Suite 1<br>Montpelier, VT 05602 |

**Team Member Organizations:**[1]

- **Connecticut** – Connecticut Green Bank, Public Utilities Regulatory Authority
- **Hawaii** – Hawaii Green Infrastructure Authority, Hawaii Public Utilities Commission
- **Puerto Rico** – Puerto Rico Green Energy Trust, Puerto Rico Department of Economic Development and Commerce

**Project Locations:**

- Connecticut
- Hawaii
- Puerto Rico

**Supporting Partners:**

- **Minority Serving Institutions** – University of Connecticut, University of Hawaii, University of New York at Albany
- **Management** – Clean Energy States Alliance
- **Technical Assistance** – Clean Energy Group

**Other Potential Partners:**

- **Utilities** – Luma Energy, Hawaiian Electric, Eversource Energy, United Illuminating
- **Consulting** – Elevate, Kevala

[1] It should be noted that there will likely be other team member organizations (e.g., state agencies, utilities, colleges, universities) if the Concept Paper is allowed to move forward.

0

## Department of Energy

Grid Innovation Program
(w/ Hawaii and Puerto Rico)

About Us ∨ Strategy + Impact ∨ Contact Us

CONNECTICUT GREEN BANK.

Solutions Customer Stories

Home / Engagement on Infrastructure Investment and Jobs Act and Inflation Reduction...

**Engagement on Infrastructure Investment and Jobs Act and Inflation Reduction Act – Public Comments and More**

Since the Fall of 2021, the Green Bank has provided public comments to various initiatives resulting from the Infrastructure Investment and Jobs Act ("IIJA") (a.k.a., Bipartisan Infrastructure Law), Inflation Reduction Act ("IRA"), and more, through agencies of the U.S. Government. The following is a breakdown of Green Bank engagement.

### US Environmental Protection Agency

- **Greenhouse Gas Reduction Fund ("GHGRF")** – a new initiative administered by the EPA to provide $27 billion in funding in support (1) zero emission technologies (e.g., residential rooftop solar PV) for low-income and disadvantaged communities, and (2) national climate bank modelled after the Connecticut Green Bank, including:
  - Press Release – August 16, 2022 applauding Congress and President Biden for the signing of the IRA, including the GHGRF modelled after Connecticut Green Bank (https://www.ctgreenbank.com/applauds-signage-of-inflation-reduction-act/)
  - Listening Session – November 9, 2022 (https://www.youtube.com/watch?v=ppwMggfbXZg&t=750s)

## Public Comments on Website

https://www.ctgreenbank.com/engagement-on-iija-ira/

# Board of Directors

## Agenda Item #10

## Adjourn

**BOARD OF DIRECTORS OF THE**
**CONNECTICUT GREEN BANK**
Regular Meeting Minutes

Friday, December 16, 2022
9:00 a.m. – 11:00 a.m.

A regular meeting of the Board of Directors of the **Connecticut Green Bank (the "Green Bank")** was held on December 16, 2022.

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

Board Members Present: Binu Chandy, Dominick Grant, John Harrity, Adrienne Houël, Laura Hoydick, Matthew Ranelli, Lonnie Reed, Sarah Sanders, Brenda Watson, Becca Trietch as designee for Victoria Hackett

Board Members Absent: Thomas Flynn, Joanna Wozniak-Brown

Staff Attending: David Beech, Larry Campana, Sergio Carrillo, Louise Della Pesca, James Desantos, Catherine Duncan, Mackey Dykes, Brian Farnen, Bryan Garcia, Sara Harari, Bert Hunter, Alex Kovtunenko, Alysse Lembo-Buzzeli, Cheryl Lumpkin, Jane Murphy, Ariel Schneider, Eric Shrago, Dan Smith, Marianna Trief

## 1. Call to Order

- Lonnie Reed called the meeting to order at 9:03 am.

## 2. Public Comments

- No public comments.

Bryan Garcia noted Agenda item 5b is being removed and 5e is being moved to immediately following 5c and asked for a motion to approve.

**Upon a motion made by Matthew Ranelli and seconded by Brenda Watson and John Harrity, the Board of Directors voted to approve the changes to the Agenda. None opposed or abstained. Motion approved unanimously.**

**3. Consent Agenda**

**a. Meeting Minutes of October 21, 2022**

**Resolution #1**

Motion to approve the meeting minutes of the Board of Directors for October 21, 2022.

**b. Energy Storage Solutions**

**Resolution #2**

**WHEREAS,** in its June 24, 2022 meeting the Board of Directors approved the implementation of an Upfront Incentive Project Approval procedure ("Procedure") involving of the issuance of a proposal for non-residential projects under consideration by the Green Bank in fulfillment of its responsibilities set forth in the Program with an estimated upfront incentive payments;

**NOW,** therefore be it:

**RESOLVED,** that the Board hereby approves the estimated upfront incentives sought by two (2) non-residential projects totaling $706,550 consistent with the memorandum provided to the Board dated December 9, 2022.

**RESOLVED,** that the proper Green Bank officers are authorized and empowered to do all other acts and execute and deliver all any documents and regulatory filings as they shall deem necessary and desirable to affect the above-mentioned incentives consistent with the Procedure and the memorandum provided to the Board dated December 9, 2022.

**c. Transactions Under $500,000 and No More in Aggregate of $1,000,000**

**Resolution #3**

**WHEREAS,** on January 18, 2013, the Connecticut Green Bank (the "Green Bank") Board of Directors (the "Board") authorized the Green Bank staff to evaluate and approve funding requests less than $300,000 which are pursuant to an established formal approval process requiring the signature of a Green Bank officer, consistent with the Green Bank Comprehensive Plan, approved within Green Bank's fiscal budget and in an aggregate amount not to exceed $500,000 from the date of the last Deployment Committee meeting, on July 18, 2014 the Board increased the aggregate not to exceed limit to $1,000,000 ("Staff Approval Policy for Projects Under $300,000"), on October 20, 2017 the Board increased the finding requests to less than $500,000 ("Staff Approval Policy for Projects Under $500,000"); and

**WHEREAS,** Green Bank staff seeks Board review and approval of the funding requests listed in the Memo to the Board dated December 16, 2022 which were approved by Green Bank staff since the last Deployment Committee meeting and which are consistent with the Staff Approval Policy for Projects Under $500,000;

**NOW,** therefore be it:

**RESOLVED,** that the Board approves the funding requests listed in the Memo to the Board dated December 16, 2022 which were approved by Green Bank staff since the last

Deployment Committee meeting. The Board authorizes Green Bank staff to approve funding requests in accordance with the Staff Approval Policy for Projects Under $500,000 in an aggregate amount to exceed $1,000,000 from the date of this Board meeting until the next Deployment Committee meeting.

**d. Managing Director of Incentive Programs Position Description**

**Resolution #4**

Motion to approve the position description for the Managing Director of Incentive Programs.

**Upon a motion made by Adrienne Houël and seconded by John Harrity, the Board of Directors voted to approve the Consent Agenda which includes Resolutions 1 – 4. None opposed or abstained. Motion approved unanimously.**

**4. Finance Programs Updates and Recommendations**

**a. C-PACE Project – Mystic, CT**

- Mackey Dykes summarized the project terms, conditions, and key metrics for a project at 62 Maritime Drive, Mystic, CT for ENKO Chemical which includes lighting, insultation, HVAC, and controls for a construction loan just under $3 million at 5% and a term loan set at a fixed 5.60% over 17 years. Mackey Dykes explained that the project would be split across two or three CPACE assessments or transactions but that staff was requesting approval for the full amount. David Beech summarized the project's underwriting.
- Lonnie Reed asked for clarification about Monsanto, one of the listed associated companies who had unsafe agricultural practices previously, and David Beech responded that Monsanto is not an investor, but that the CEO of ENKO Chemical had a leadership position there before starting ENKO Chemical.

**Resolution #5**

**WHEREAS,** pursuant to Connecticut General Statute Section 16a-40g (the "Statute"), the Connecticut Green Bank ("Green Bank") is directed to establish a commercial sustainable energy program for Connecticut, known as Commercial Property Assessed Clean Energy ("C-PACE");

**WHEREAS,** the Green Bank Board of Directors (the "Board") has approved a $40,000,000 C-PACE construction and term loan program;

**WHEREAS,** the Green Bank seeks to provide a $2,958,385 term loan under the C-PACE program to Enko Realty, LLC., the building owner of 62 Maritime Dr., Mystic, Connecticut (the "Loan"), to finance the construction of specified clean energy measures in line with the State's Comprehensive Energy Strategy and the Green Bank's Strategic Plan.

**NOW,** therefore be it:

**RESOLVED,** that the President of the Green Bank and any other duly authorized officer of the Green Bank is authorized to execute and deliver the Loan in an amount not to be greater than one hundred ten percent of the Loan amount with terms and conditions consistent with the

memorandum submitted to the Green Bank Board of Directors (the "Board") dated December 9, 2022, and as he or she shall deem to be in the interests of the Green Bank and the ratepayers no later than 120 days from the date of authorization by the Board;

**RESOLVED,** that before executing the Loan, the President of the Green Bank and any other duly authorized officer of the Green Bank shall receive confirmation that the C-PACE transaction meets the statutory obligations of the Statute, including but not limited to the savings to investment ratio and lender consent requirements; and

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

**Upon a motion made by Binu Chandy and seconded by John Harrity, the Board of Directors voted to approve Resolution 5. None opposed or abstained. Motion approved unanimously.**

**b. C-PACE Project – Redding, CT**

- Mackey Dykes reviewed the financial metrics, terms, conditions, and other key metrics for a project at 100 Redding Rd, Redding, CT for Meadow Ridge Assisted Living which includes rooftop and carport solar PV, roof repairs, and EV charging infrastructure for a loan of $3.2 million at 5% and a term loan set at a fixed 5.75% over 20 years. Louise Della-Pesca summarized the project's underwriting.

**Resolution #6**

**WHEREAS,** pursuant to Connecticut General Statute Section 16a-40g (the "Statute"), the Connecticut Green Bank (Green Bank) is directed to, amongst other things, establish a commercial sustainable energy program for Connecticut, known as Commercial Property Assessed Clean Energy ("C-PACE");

**WHEREAS**, the Green Bank Board of Directors (the "Board") has approved a $40,000,000 C-PACE construction and term loan program;

**WHEREAS,** the Green Bank seeks to provide a $3,213,498 construction and (potentially) term loan under the C-PACE program to Redding Life Care, LLC, the building owner of 100 Redding Road, Redding, Connecticut (the "Loan"), to finance the construction of specified clean energy measures in line with the State's Comprehensive Energy Strategy and the Green Bank's Strategic Plan; and

**NOW,** therefore be it:

**RESOLVED,** that the President of the Green Bank and any other duly authorized officer of the Green Bank is authorized to execute and deliver the Loan in an amount not to be greater than one hundred ten percent of the Loan amount with terms and conditions consistent with the memorandum submitted to the Committee dated December 9, 2022, and as he or she shall deem to be in the interests of the Green Bank and the ratepayers no later than 120 days from the date of authorization by the Board of Directors;

**RESOLVED,** that before executing the Loan, the President of the Green Bank and any other duly authorized officer of the Green Bank shall receive confirmation that the C-PACE transaction meets the statutory obligations of the Statute, including but not limited to the savings to investment ratio and lender consent requirements; and

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

**Upon a motion made by Brenda Watson and seconded by Binu Chandy, the Board of Directors voted to approve Resolution 6. None opposed or abstained. Motion approved unanimously.**

**c. C-PACE New Construction project (Co-Investment with Nuveen) – Hartford, CT**

- Mackey Dykes reviewed the financial metrics, terms, conditions, and other key metrics for a project at 237 Hamilton St, Hartford, CT for a real estate developer which includes the rehabilitation of a former factory to a mixed-use commercial and residential complex for a $26.4 million loan but only in principle and to approve support of the project at this time. Once terms are formally negotiated, staff would return to the Board of Directors for formal approval to invest.
- Brenda Watson asked about the developer for the project and the equity return for the community for the project, as in how many residential units will be affordable, will there be an emphasis placed on diversity, and other measures. Mackey Dykes responded that he hasn't gotten to negotiating any of those points yet then elaborated on the points that had been discussed which included high-level terms for any C-PACE transaction.
- Matthew Ranelli asked about the environmental impact of and environmental diligence done for the project. He also mentioned the possibility of getting environmental insurance for projects like this going forward to protect the Green Bank's collateral. Brian Farnen responded that the due diligence items Matthew Ranelli asked about will be addressed up during the next steps and the due diligence process. Brenda Watson also added to look into housing equity and environmental issues which may be connected to this development.
- Binu Chandy supplied the DECDDC Affordable Housing Policy in the discussion.
- John Harrity asked if the developers have confidence that they can fill the spaces. Mackey Dykes responded that it will be part of the due diligence but there was a market study done which shows there is a demand.

**Resolution #7**

**RESOLVED**, that the Connecticut Green Bank ("Green Bank") is authorized in principle to enter into negotiations and documentation for co-investment in up to $26,395,850 in C-PACE financing for 237 Hamilton Street, Hartford, CT as more fully explained in the memorandum to the Green Bank Board of Directors (the "Board") dated December 9, 2022; provided such negotiation and documentation shall include detailed information regarding the environmental conditions existing at the property and any equitable housing component of the proposed project, however, that authorization to enter into definitive documentation is pending further diligence by staff and approval by the Board at a future meeting.

**Upon a motion made by Matthew Ranelli and seconded by John Harrity, the Board of Directors voted to approve Resolution 7 modified to include a provision to have the Board direct staff to present out for any final approval the environmental due diligence that was done and any housing equity or affordable housing components of this project in greater detail. None opposed or abstained. Motion approved with the amendment unanimously.**

**5. Investment Updates and Recommendations**

**a. Extension Request – Groton Fuel Cell Project**

- Bert Hunter summarized the extension request to March 31, 2023 for the Groton Fuel Cell Project, which has been operating continuously since September 2022, except for scheduled downtime. The operating issues brought forward in October are causing a lower output and will require operating the fuel cells at 6 MW instead of 7.4 MW until full repairs can be made later in 2023.

**Resolution #8**

**WHEREAS,** FuelCell Energy, Inc., of Danbury, Connecticut ("FCE") has requested financing support from the Green Bank to develop a 7.4 megawatt fuel cell project in Groton, Connecticut located on the U.S. Navy submarine base and supported by a power purchase agreement ("PPA") with the Connecticut Municipal Electric Energy Cooperative ("CMEEC") (the "Navy Project");

**WHEREAS,** staff has considered the merits of the Navy Project and the ability of FCE to construct, operate and maintain the facility, support the obligations under the Loan throughout its 20-year term, and as set forth in the due diligence memorandum (the "Board Memo") dated December 18, 2020, recommended this support be in the form of a term loan not to exceed $8,000,000, secured by the developer's equity in the project company (which controls all project assets, contracts and revenues) as well as a pledge of revenues from an unencumbered project as explained in the Board Memo (the "Credit Facility");

**WHEREAS,** on the basis of that recommendation, the Green Bank Board of Directors ("Board") approved of the Credit Facility, in an amount not to exceed $8,000,000 with the provision that the Credit Facility be executed no later than 315 days from the date of authorization by the Board (June 16, 2021), which was further extended by the Board on a number of occasions, including in July 2022 to October 31, 2022;

**WHEREAS,** Green Bank staff has further advised the Board that the closing for the Credit Facility is expected to close by March 31, 2023 and to accommodate the additional time that might be needed to execute the Credit Facility requests the permitted time to execute the credit facility be increased from not later than October 31, 2022 to not later than March 31, 2023;

**NOW,** therefore be it:

**RESOLVED,** that the Green Bank Board hereby approves the extension of time for the execution of the Credit Facility to not later than March 31, 2023); and

**RESOLVED,** that the proper Green Bank officers are authorized and empowered to do all other acts and execute and deliver all other documents and instruments as they shall deem necessary and desirable to affect the Term Loan and participation as set forth in the Memorandum.

**Upon a motion made by Brenda Watson and seconded by Adrienne Houël, the Board of Directors voted to approve Resolution 8. None opposed and Matthew Ranelli abstained. Motion approved.**

**b. Capital Solutions Request – Budderfly (Co-Investment with Berkshire Bank)**

**Resolution #9**

- This agenda item and Resolution were deferred.

**c. Investment Modification Request (extension) – C4C (Co-Investment with Amalgamated Bank)**

- Bert Hunter summarized the request made for the C4C Loan Facility which is to extend the loan by 90 days to March 31, 2023.

**Resolution #10**

**WHEREAS,** the Connecticut Green Bank ("Green Bank") entered into a Smart-E Loan program financing agreement with Capital for Change ("C4C");

**WHEREAS,** C4C is the largest Smart-E lender on the Green Bank Smart-E platform;

**WHEREAS,** C4C, Amalgamated Bank and Green Bank have substantially completed negotiations for modification to the medium term loan facility to fund C4C's Smart-E Loan and other residential energy efficiency loan portfolio growth on revised terms as explained in the memorandum dated October 18 to the Connecticut Green Bank ("Green Bank") Board of Directors (the "Board") (the "Modification Memo"); and

**WHEREAS,** Green Bank staff recommends approval by the Board for an amended secured and subordinated medium term revolving loan facility for CEEFCo (the "Amended CEEFCo Revolving Loan") in order to fund CEEFCo's residential energy efficiency and Smart-E Loan portfolio in partnership with Amalgamated Bank.

**NOW,** therefore be it:

**RESOLVED,** that the Board approves the Amended CEEFCo Revolving Loan in an amount of up to $10 million in capital from the Green Bank balance sheet in support of energy efficiency and Smart-E Loans in partnership with Amalgamated Bank generally consistent with the Modification Memo;

**RESOLVED,** that the President of the Green Bank; and any other duly authorized officer of the Green Bank, is authorized to execute and deliver, any contract or other legal instrument necessary to affect the CEEFCo Revolving Loan on such terms and conditions as are materially

consistent with the Modification Memo; and

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

**Upon a motion made by Brenda Watson and seconded by Sarah Sanders, the Board of Directors voted to approve Resolution 10. None opposed or abstained. Motion approved unanimously.**

**d. Investment Modification Request – PosiGen (Co-Investment with Forbright Bank)**

- Bert Hunter summarized the PosiGen Senior Facility transaction with Forbright Bank and the proposed change to increase the Green Bank's maximum exposure under the facility's accordion option from $6.4 million to $9.3 million. He reviewed the risk assessment, but the portfolio remains strong and the lease structure is aligned with the bill savings benefits. As well, the Green Bank's overall facility exposure would be nominally increased, from $24.4 million to $30.8 million and explained where the sources of those increases are coming from.

**Resolution #11**

**WHEREAS,** the Connecticut Green Bank ("Green Bank") has an existing partnership with PosiGen, Inc. (together with its affiliates and subsidiaries, "PosiGen") to support PosiGen in delivering a solar lease (including battery storage) and energy efficiency financing offering to LMI households in Connecticut;

**WHEREAS,** the Green Bank Board of Directors ("Board) previously authorized and later amended the Green Bank's participation in a back leverage credit facility (the "BL Facility") collateralized by all of PosiGen's solar PV system and energy efficiency leases in the United States as part of PosiGen's strategic growth plan, as well as a facility to finance performance based incentives earned by PosiGen on its solar PV portfolio in Connecticut;

**WHEREAS,** PosiGen is now in the process of upsizing its BL Facility, as explained in the memorandum to the Board dated December 9, 2022 (the "Board Memo");

**WHEREAS,** PosiGen repayment performance is satisfactory;

**NOW,** therefore be it:

**RESOLVED,** that the Board authorizes the Green Bank to amend its existing 2nd lien facility to allow for an upsized Green Bank position, as set forth in the Board Memo;

**RESOLVED,** that the Green Bank may advance up to $9.3 million in 2nd lien financing associated with the BL Facility, in addition to serving as an agent for third-party participation to increase those participations to reduce Green Bank's exposure as explained in the Board Memo;

**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 affect the above-mentioned legal instruments.

**Upon a motion made by Matthew Ranelli and seconded by John Harrity, the Board of Directors voted to approve Resolution 11. None opposed or abstained. Motion approved unanimously.**

**e. Investment Modification Request – Energy Resources USA LLC**

This item was addressed after 5c.

- Bert Hunter summarized the Energy Resources USA transaction with the proposed change to allow the borrower to pay down the facility and redraw within the 2-year availability period to fund several SBEA projects for the State of CT secured by repayment from Eversource.
- Sarah Sanders asked for clarification about the hold on SBEA projects. Mackey Dykes responded that he has a limited understanding, but the Attorney General's office flagged an issue in the agreement and so any further use of the SBEA financing requires a statutory change, which is in the works. He stated he is happy to share more once he can get that information.

**Resolution #12**

**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 revolving construction loan facility (the "Construction Loan"), substantially on the terms and conditions explained in a memorandum to the Green Bank Board of Directors (the "Board") dated December 9, 2022 (the "Board Memo");

**NOW,** therefore be it:

**RESOLVED,** that the Green Bank approves the Capital Solutions application of Energy Resources and the establishment of a revolving 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 Board 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 affect the above-mentioned legal instruments.

**Upon a motion made by Matthew Ranelli and seconded by Adrienne Houël, the Board of Directors voted to approve Resolution 12. None opposed or abstained. Motion approved unanimously.**

**f. Capital Solutions Request – PosiGen (ITC Bridge Facility)**

- Bert Hunter summarized the PosiGen transaction with M&T Bank with new IRA "adders" which require Treasury Department guidance which will delay some advances on tax equity, and so there is a request for a $6 million 2-year senior secured facility to bridge payments from that tax equity and tax credit "adders." It would be a revolving facility with a limitation on exposure overall. He reviewed the proposal score for the transaction which includes a bonus point for LMI or Underserved Communities resulting in a score of 25 out of 24 points.
- Matthew Ranelli asked for clarification about the financial bridge, asking if there is a high comfort level or backup plan if PosiGen doesn't meet what the guidance is. Bert Hunter responded that the advances will be subject to the Green Bank's discretion, and diligence will be done to make sure their application will go through. Bryan Garcia added that as the Low Income Adder was being debated at the national level, PosiGen was actively involved in the discussions and worked to involve the CT Congressional Delegation in those discussions. As well, under the 1.8 GW allocation, the US Government reached out to the Connecticut Green Bank for assistance on how to make the process easier, given the Green Bank's results which speaks to the excellent work of the team to demonstrate results.

**Resolution #13**

**WHEREAS,** the Connecticut Green Bank ("Green Bank") has an existing partnership with PosiGen, Inc. (together with its affiliates and subsidiaries, "PosiGen") to support PosiGen in delivering a solar lease (including battery storage) and energy efficiency financing offering to LMI households in Connecticut;

**WHEREAS,** the Green Bank Board of Directors ("Board) previously authorized and later amended the Green Bank's participation in a back leverage credit facility (the "BL Facility") collateralized by all of PosiGen's solar PV system and energy efficiency leases in the United States as part of the company's strategic growth plan, as well as a facility to finance performance based incentives earned by PosiGen on its solar PV portfolio in Connecticut;

**WHEREAS,** PosiGen repayment performance is satisfactory;

**WHEREAS,** the passage of the federal Inflation Reduction Act of 2022 (the "IRA") creates a variety of new tax credit value streams that are available in early 2023 but likely to be delayed in terms of monetizable cash flow as explained in the memorandum to the Board dated December 9, 2022 (the "Board Memo");

**WHEREAS,** PosiGen is currently documenting a new tax equity facility that will incorporate that additional value from IRA and has applied under the Capital Solutions Open RFP program for a revolving loan facility to bridge this value to be derived from the IRA provisions being included in the Internal Revenue Code, as further explained in the Board Memo; and

**NOW,** therefore be it:

**RESOLVED,** that the Green Bank may advance up to $6 million in 1st lien financing associated with tax equity cash flows under a revolving loan facility as further explained in the Board 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 affect the above-mentioned legal instruments.

**Upon a motion made by Matthew Ranelli and seconded by Brenda Watson, the Board of Directors voted to approve Resolution 13. None opposed or abstained. Motion approved unanimously.**

**g. Investment Modification Request (Collateral & Guaranty) – Canton Hydro Project**

- Marianna Trief summarized the Canton Hydro project which has final completion delayed and with IPC coming in to take over from the planned SBA loan, there is a request from Provident Bank to trigger the Green Bank Guaranty when IPC Participation is finalized instead of at Final Completion. The staff is requesting 50% of the Guaranty by December 30, 2022 with the remaining 50% to unlock upon IPC's full refinancing. At that point, the Green Bank would receive a perfected security interest in all project assets, subordinate only to the senior lenders. As well, there is a proposed increase in Loan by 1% to unlock the first 50% of the Guaranty.
- Matthew Ranelli asked about the nature of the delay. Marianna Trief answered the EPC contractor is a foreign company and the dispute is working to be resolved then explained more about the process surrounding the delay. Alex Kovtunenko added the unlocking to 50% Guaranty requirement is a request from the Senior Lender who has been working in good faith by not enforcing their senior position and dealing with delays on their side as well.

**Resolution #14**

**WHEREAS,** Canton Hydro, LLC ("Developer") was awarded exclusivity by the Town of Canton to redevelop a 1 MW hydroelectric facility located at the Upper Collinsville Dam ("Dam"), on the Farmington River, in Canton, Connecticut (the "Project") and the Connecticut Green Bank ("Green Bank") Board (the "Board") approved approve subordinate debt financing in an amount to exceed $1,200,000 (the "Loan") along with an unfunded guaranty, in an amount not to exceed $500,000 to support the Project ("Guaranty");

**WHEREAS,** Green Bank's debt was leveraged by a term loan from Provident ("Provident Loan"), as well as loan supported by the US Small Business Administration ("SBA") 504 program ("SBA Loan");

**WHEREAS,** the Project Developers are seeking to replace the SBA Loan with new funding or a new loan from Inclusive Prosperity Capital ("IPC Loan") and are seeking Green Bank's approval to trigger the benefit of 50% of the Guaranty before final completion of the Project and to extend the Project's completion of construction date until June 30, 2023, as more fully explained in a memorandum to the Board dated December 13, 2022 (the "Board Memo");

**WHEREAS,** to accommodate the Project Developers' and senior lenders requests, Green Bank would increase the interest rate on the Loan by 1% until it receives a restructured security package for the Loan as described in the Board Memo

.

**NOW,** therefore be it:

**RESOLVED,** that the Green Bank Board of Directors hereby authorize staff to execute an amendment of the Loan agreement and Guaranty materially based on the terms and conditions set forth in the Board Memo;

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

**Upon a motion made by Binu Chandy and seconded by Brenda Watson, the Board of Directors voted to approve Resolution 14. None opposed or abstained. Motion approved unanimously.**

**6. Incentive Programs Updates and Recommendations**

**a. Energy Storage Solutions: Approval Process**

- Sergio Carrillo summarized the ESS Incentive Approval Process and a proposed amendment to include the Deployment Committee as an approver to approve incentives above $500,000 but under the Deployment Committee's threshold of $2.5 million, and to include multi-family affordable housing in the approval process in response to a recent decision by PURA in the RRES Program, which approved the treatment of multi-family affordable housing as residential customers. Multi-family projects would be up to the $7500 maximum multiplied by the number of units in the building, which could push those upfront incentive requests into Board approval values over $500,000.
- Becca Trietch asked who comprises the Deployment Committee. Bryan Garcia answered that it is comprised of Board members and is not a committee of outside participants.

**Resolution #15**

**WHEREAS,** the Connecticut Green Bank ("Green Bank") was appointed Co-Administrator to the Energy Storage Solutions (ESS) Program ("Program") by PURA pursuant its Final Decision, within Docket No. 17-12-03RE0 (PURA Investigation into Distribution System Planning of the Electric Distribution Companies – Electric Storage) on July 28, 2021 (the "Final Decision");

**WHEREAS,** the Program responsibilities of the Green Bank established by the Final Decision, include customer enrollment, upfront incentive administration, communication and promotion of the Program, and data aggregation and publication;

**WHEREAS,** at the June 24, 2022 meeting the Board of Directors (the "Board") approved the implementation of a process to approve and issue Program incentives, Green Bank staff seeks to clarify and amend the approval process, as set forth below;

**WHEREAS,** the Green Bank proposes to administer the upfront incentive payments as through (i) the issuance of a Reservation of Funds (ROF) letter, provided to the project developer and customer upon verification that the Battery Energy Storage System (BESS) meets the minimum technical requirements necessary to participate in the Program, including equipment roundtrip efficiency and warranty, ability to comply with passive and active dispatch modes, and demonstrated ability to communicate with the dispatch platforms; (ii) the issuance of a Confirmation of Funds (COF) letter upon the completed installment of all equipment, the procurement of required utility permits, and the verification of connectivity with dispatch platforms;

**WHEREAS,** incentives for residential customers will be administrated and issued by Green Bank staff similar to how Green Bank administrated the Residential Solar Investment Program (RSIP). Green Bank staff will issue ROFs, COFs, and incentive payments to residential customers in accordance with the ESS program rules and this Memo. Green Bank staff will periodically report out to the Board on the progress to targets and incentives issued to such residential customers;

**WHEREAS,** incentives below $500k for multi-family affordable housing and non-residential customers will be approved by Green Bank staff, and will be issued a ROF letter upon approval. Projects which were approved and issued an ROF letter will be reflected in the "under $500k" memo to the Board or DC, as may be applicable. Projects will receive COF letters and incentives pursuant to the staff approvals; and

**WHEREAS,** incentives equal to or greater than $500k for multi-family affordable housing and non-residential customer projects shall be presented in accordance with this Memo to the Board or DC, subject to applicable limitations, for approval on the consent agenda. Once approved by the Board or DC, Green Bank staff will issue ROF letters. The subsequent COF letters and incentives will be issued in accordance with such Board or DC approval. Green Bank staff will periodically report out to the Board the actual incentives issued.

**NOW,** therefore be it:

**RESOLVED,** that the Board hereby approves the Green Bank's proposed changes to the process of administration of upfront Program incentive payments as set forth in the memorandum to the Board dated December 9, 2022 (the "Memorandum");

**RESOLVED,** that the Board hereby approves the Green Bank staff proposed process for upfront incentive payments under $500,000 to residential, multi-family affordable housing and non-residential customers in accordance with Memo and existing staff approval processes;

**RESOLVED,** that the Board hereby approves the Green Bank staff proposed process for presenting upfront incentive payments equal to or over $500,000 to multi-family affordable housing and non-residential customers to the Board or DC for approval, on the consent agenda, in accordance with the Memo; and

**RESOLVED,** Green Bank staff will periodically report out to the Board on the progress to targets and incentives issued under the Program, explaining any changes between ROF estimated incentives and actual incentives issued.

**Upon a motion made by Matthew Ranelli and seconded by Binu Chandy, the Board of**

**Directors voted to approve Resolution 15. None opposed or abstained. Motion approved unanimously.**

**7. Other Business**

**a. Inflation Reduction Act – Incentive Maze and GHG Reduction Fund**

- Bryan Garcia reviewed the Inflation Reduction Act which was signed into law on August 16, 2022 and has granted many credits and adders that benefit Connecticut with the potential to reach its clean energy targets and goals, though it is a new maze to navigate and there is a desire to make that navigation as simple as possible. Alex Kovtunenko summarized many of the federal opportunities and tax credits that the IRA allows with more expected as diligence with the IRS is done to fully understand all possibilities. Bryan Garcia added that when the bill was passed, the staff was excited to dive into it and help provide comments, explanations, and definitions to understand it.
- Bryan Garcia noted that the bill also included developing a National Climate Bank. He also commented that the Connecticut Green Bank is working hard to maximize Connecticut's receipt from the Greenhouse Gas Reduction Fund since the team have been leading the way in this field with repeated demonstrations of success then reviewed some of the most recent achievements and comments submitted.
- Bryan Garcia reviewed the Top 5 Priority Use Cases to demonstrate how to navigate the incentive maze and make it easier which includes Resiliency Hubs, Residential Home Energy Performance, Municipal Buildings, Solutions for Renters, and Non-Residential. Mackey Dykes explained the Residential Home Energy Performance piece of the opportunities available under Affordable Housing as an example of the many new possibilities under the IRA.
- Matthew Ranelli asked if the BOC Committee has thought to add staff to drive projects into the new opportunities available. Mackey Dykes responded that it is a key part of the recommendation to be brought forward, especially in the next 6 months, in order to grow and fully take advantage of the opportunities.

**b. Other Business**

- Bryan Garcia noted that the Green Bank has been involved in some of the public comments for the recent federal matters and recognized Commissioner Dykes and Becca Trietch for their effort to get a letter into the EPA from 12 states which will hopefully advantage them to receive funding from the Greenhouse Gas Reduction Fund.

**8. Personnel Related Matters – Officer FY22 Performance Review**

**Resolution #16**

**WHEREAS,** Section 3.1 of the Connecticut Green Bank (Green Bank) Bylaws provides that the Board of Directors (Board) shall be responsible for determining or approving compensation for the officers;

**WHEREAS,** on June 24, 2022, the Board approved a 4.0% merit pool in its FY 2023

budget for annual merit adjustments that can range from 0.0% to 5.0%;

**WHEREAS,** the Green Bank has completed its annual performance review process based on the Board approved annual goals and 360-degree performance reviews from the staff;

**WHEREAS,** the President and C.E.O. of the Green Bank recommends a 4.0% merit increase for the Officers other than himself and authorizing the Chair to determine the President and C.E.O.

**NOW,** therefore be it:

**RESOLVED,** that all Officers other than the President and C.E.O. shall receive a 4.0% merit increase for Fiscal Year 2022; and

**RESOLVED,** that the Board authorizes the Chair of the Green Bank to determine the merit compensation adjustment for the President and C.E.O. for FY 2022 based on the (i) feedback of the Board members, (ii) performance towards meeting the Green Bank Board approved organizational goals for Fiscal Year 2022 and (iii) his Fiscal Year 2022 360-degree performance review.

**Upon a motion made by Matthew Ranelli and seconded by Adrienne Houël, the Board of Directors voted to approve Resolution 16. None opposed and Becca Trietch abstained. Motion approved.**

**9. Adjourn**

**Upon a motion made Lonnie Reed, the Board of Directors Meeting adjourned at 11:02 am.**

Respectfully submitted,

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Lonnie Reed, Chairperson

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CONNECTICUT GREEN BANK

# Memo

**To:** Board of Directors of the Connecticut Green Bank

**From:** Sergio Carrillo, Bryan Garcia

**Cc** Mackey Dykes, Brian Farnen, Bert Hunter, Jane Murphy, and Eric Shrago

**Date:** January 20, 2023

**Re:** Energy Storage Solution Program – Upfront Incentive Change Notification and Approvals

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The Energy Storage Solutions (ESS) Program was established by PURA in Docket No. 17-12-03RE03, PURA Investigation into Distribution System Planning of the Electric Distribution Companies – Electric Storage. In its Final Decision[1] in this docket, issued July 28, 2021, PURA appointed The Connecticut Light and Power Company d/b/a Eversource Energy (Eversource), The United Illuminating Company (UI), and the Connecticut Green Bank (Green Bank) as co-administrators of the Program.[2]

The Green Bank's responsibilities include customer enrollment, administration of the upfront incentive, marketing and promotion, and data aggregation and publication to support evaluation, measurement, and verification, among others.

## A. Upfront Incentive Approval Process

In its June 24, 2022 Board meeting, the Green Bank Board approved a process for the approval of upfront incentives for projects participating in the ESS Program by which projects with estimated upfront incentives greater than $500,000 would follow a process similar to the one used by C-PACE.

Within the existing Board of Directors and Deployment Committee regular meeting schedule, the Green Bank staff will seek BOD approval of these upfront incentives via consent agenda, and only after the upfront incentives are approved by the BOD, Green Bank staff will issue Reservation of Funds (ROF) letters.

The Board approved that Green Bank staff shall obtain Board approval of estimated upfront incentive payments via consent agenda utilizing the Tear Sheet process described in the

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[1] https://tinyurl.com/2p8v4cwa

[2] It should also be noted that with the passage of Public Act 21-53 "An Act Concerning Energy Storage," that PURA shall solicit input from DEEP, OCC, EDC's, and the Green Bank in developing energy storage system programs, and may select DEEP, EDC's, Green Bank, a third party, or any combination thereof to implement one or more programs for electric storage resources as directed by PURA.

Memorandum to the Board dated June 24, 2022. Only after securing Board approval, will Green Bank Staff issue ROF letters to project developers and/or owners.

After projects are fully operational, Green Bank staff will notify the BOD of their intent to issue Confirmation of Funds (COF) letters, highlighting any differences between the Board-approved incentive and the final incentive amount, and the reason for the difference.

## B. Initial Board Approval of Estimated Upfront Incentives

In its July 22, 2022 Board meeting, the Board approved estimated upfront incentives for 13 non-residential projects totaling amount of $16,513,170 and an aggregate capacity of 33.8 MW.

These projects are small, medium, and large[3] commercial and industrial projects, and are expected to come online in 2023 and 2024, due to their complexity and distribution and transmission interconnection studies triggered by the size of the batteries being proposed, which can be lengthy and costly. Batteries with power rating above 2 MW (2,000 kW) will require distribution studies, while batteries above 5 MW (5,000 kW) will also require transmission studies.

Table 1 below shows the list of 13 projects that received Board approval of their estimated upfront incentives.

| Project Name | Contractor Account | Application Submitted Date | FCM | Upfront Incentive | Battery Manufacturer | Battery Model | Total System Energy Capacity | Total System Power (kW) |
|---|---|---|---|---|---|---|---|---|
| ESS-00014 | CPower | 1/14/2022 | No | $ 1,800,000 | Tesla | Megapack | 18,000 | 6,000 |
| ESS-00017 | CPower | 1/14/2022 | Yes | $ 3,675,000 | Tesla | Megapack | 21,000 | 7,000 |
| ESS-00019 | CPower | 1/14/2022 | No | $ 3,300,000 | Tesla | Megapack | 16,500 | 5,500 |
| ESS-00021 | CPower | 1/14/2022 | Yes | $ 1,620,000 | Tesla | Megapack | 16,200 | 5,400 |
| ESS-00031 | ConEdison Solutions | 1/19/2022 | No | $ 537,320 | Tesla | Megapack | 3,070 | 768 |
| ESS-00034 | ConEdison Solutions | 1/19/2022 | Yes | $ 614,080 | Tesla | Megapack | 3,070 | 768 |
| ESS-00035 | ConEdison Solutions | 1/19/2022 | No | $ 1,074,640 | Tesla | Megapack | 6,141 | 1,535 |
| ESS-00036 | ConEdison Solutions | 1/19/2022 | Yes | $ 614,080 | Tesla | Megapack | 3,070 | 768 |
| ESS-00037 | ConEdison Solutions | 1/28/2022 | No | $ 613,600 | Tesla | Megapack | 3,068 | 767 |
| ESS-00038 | ConEdison Solutions | 1/25/2022 | No | $ 537,250 | Tesla | Megapack | 3,070 | 767 |
| ESS-00040 | ConEdison Solutions | 1/28/2022 | No | $ 613,600 | Tesla | Megapack | 3,068 | 767 |
| ESS-00048 | ConEdison Solutions | 1/28/2022 | No | $ 613,600 | Tesla | Megapack | 3,068 | 767 |
| ESS-00172 | CPower | 3/10/2022 | No | $ 900,000 | Tesla | Megapack | 9,000 | 3,000 |
| | | | | **$ 16,513,170** | | | **108,326** | **33,807** |

***Table 1. Summary of Estimated Upfront Incentives***

[3] Small: < 200 kW average annual demand; Medium: 200-500 kW average annual demand; Large: 500 kW+ average annual demand. Note that the Program Administrators are requesting to PURA to modify these parameters starting in 2023.

## C. Changes to Previously Board-Approved Upfront Incentives

After consultation with the EDCs and careful consideration, Program Administrators decided to reassess the annual peak demand provided for 4 of the 13 projects that had received Board approval in July.

This reassessment resulted in changes to the estimated upfront incentives as shown in Table 2.

| Project Name | Contractor Account | Sector | Original Estimated Upfront Incentive | Reassessed Final Upfront Incentive | Reason for Change in Upfront Incentive |
|---|---|---|---|---|---|
| ESS-00017 | CPower | C&I | $ 3,675,000 | $ 2,100,000 | Medium to Large customer after demand was reviewed |
| ESS-00019 | CPower | C&I | $ 3,300,000 | $ 2,887,500 | Small to Medium customer after demand was reviewed |
| ESS-00021 | CPower | C&I | $ 1,620,000 | $ 2,835,000 | Large to Medium customer after demand was reviewed |
| ESS-00035 | ConEdison Solutions | C&I | $ 1,074,640 | $ 614,080 | Medium to Large customer after demand was reviewed |
| | | | **$ 10,821,040** | **$ 9,587,980** | |

***Table 2. Summary of Changes in Estimated Upfront Incentives***

The overall change in the estimated upfront incentives for these 4 projects is a reduction in the amount of $1,233,060; which is expected to have a positive impact in the ESS Program Ratepayer Impact Measure (RIM),and will translate into increased benefits to all ratepayers.

## D. Request for Approval of New Upfront Incentives Above $500,000

Table 3 below shows the single project seeking estimated upfront incentives for a total amount of $598,917 and total capacity of 2.569 MW, which accounts for 5% of the original 50 MW of non-residential capacity available for the 2022-2024 cycle.

This project is a small commercial and industrial project that is expected to come online in 2024, due to its complexity and distribution and transmission interconnection studies triggered by the size of the batteries being proposed, which can be lengthy and costly. Batteries with power rating above 2 MW (2,000 kW) will require distribution studies, while batteries above 5 MW (5,000 kW) will also require transmission studies.

This project proposes to use one or multiple Tesla Megapack(s) which is a very popular battery model in commercial applications.

| Project Name | Contractor Account | Application Submitted Date | FCM | Estimated Upfront Incentive | Battery Manufacturer | Battery Model | Total System Energy Capacity (kWh) | Total System Power (kW) |
|---|---|---|---|---|---|---|---|---|
| ESS-00159 | Enel X North America | 3/8/2022 | Yes | $ 598,917 | Tesla | Megapack | 5,139 | 2,569 |

***Table 3. Summary of Estimated Upfront Incentives***

## E. Request for Approval of New Upfront Incentives Under $500,000

This memo provides a report out and request to clear the queue on funding requests below $500,000 that were evaluated and approved by Green Bank Staff via Project Approval Forms (PAFs).

Table 4 below shows the six (6) projects seeking approval of estimated upfront incentives for a total amount of $1,869,906, and aggregate capacity of 4.338 MW. Green Bank staff has not issued Reservation of Fund (ROF) letters as the amount of Projects is above the aggregate amount of one million dollars. As part of this request to the Board, we are seeking authorization to issue ROFs for the projects listed below.

| Project Name | Contractor Account | Application Submitted Date | FCM | Estimated Upfront Incentive | Battery Manufacturer | Battery Model | Total System Energy Capacity (kWh) | Total System Power (kW) |
|---|---|---|---|---|---|---|---|---|
| ESS-00041 | QCells Enable | 1/21/2022 | No | $ 111,600 | Socomec | Sunsys HES L | 1,116 | 500 |
| ESS-00177 | Enel X North America | 3/15/2022 | No | $ 331,800 | Tesla | Megapack | 2,568 | 1,284 |
| ESS-00179 | HQCA Energy Solutions | 3/17/2022 | No | $ 55,800 | Socomec | Sunsys HES L | 558 | 250 |
| ESS-00193 | ConEdison Solutions | 3/24/2022 | No | $ 456,902 | Tesla | Megapack | 3,070 | 768 |
| ESS-00194 | ConEdison Solutions | 3/24/2022 | No | $ 456,902 | Tesla | Megapack | 3,070 | 768 |
| ESS-00195 | ConEdison Solutions | 3/24/2022 | No | $ 456,902 | Tesla | Megapack | 3,070 | 768 |
| | | | | **$ 1,869,906** | | | **13,452** | **4,338** |

***Table 4. List of projects with incentives under $500K approved by Green Bank Staff via Project Approval Forms (PAFs)***

With the approval of these seven (7) new projects, and the restatement of previously approved incentives, the total approved capacity will be 46.4 MW, which represents 93.4% of the C&I capacity available for the 2022-2024 tranche.

Once incentive approvals reach 50 MW, Green Bank will make available the next C&I capacity tranche of 100 MW corresponding to the period 2025-2027.

The attached Tear Sheets provide these and other details pertaining to the six new projects seeking estimated upfront incentives in the ESS Program.

---

## Resolution

**WHEREAS,** in its June 24, 2022 meeting the Connecticut Green Bank Board of Directors (Board) approved the implementation of an Upfront Incentive Project Approval procedures ("Procedures") for non-residential projects under the Energy Storage Solutions Program (Program) with an estimated upfront incentive payment greater than $500,000 and procedures for less than $500,000;

**WHEREAS**, as part of the approved Procedures, Green Bank staff shall present Program projects via the consent agenda utilizing a standard form Tear Sheet process described in the memorandum to the Board dated June 24, 2022;

**WHEREAS**, in its December 9, 2002 meeting the Board approved updated Procedures to better align with the Program process;

**WHEREAS**, in its July 22, 2022 meeting the Board approved that upfront incentive payments of 13 non-residential projects totaling $16,513,170 and an aggregate capacity of 33.8 MW;

**WHEREAS**, the Program administrators, which include the Green Bank and our utility partners, reassessed the annual peak demand of 4 projects that had previously received Board approval of their estimated upfront incentives;

**WHEREAS**, the reviewed amount of these upfront incentives represents a reduction in the amount of $1,233,060; which is expected to have a positive impact in the Program Ratepayer Impact Measure (RIM);

**WHEREAS**, Green Bank Staff reviewed funding requests for projects with incentives below $500,000, and approved them via Project Approval Forms for a total amount of $1,869,906 and intends to issue Reservation of Fund letters upon Board authorization.

**NOW**, therefore be it:

**RESOLVED**, that the Board hereby approves the reassessed upfront incentives sought by 4 non-residential projects totaling $9,587,980 from their original $10,821,040;

**RESOLVED**, that the Board hereby approves the estimated upfront incentives sought by 1 non-residential projects above $500,000 totaling $598,917 consistent with the approved Procedures;

**RESOLVED**, that the Board hereby approves the estimated upfront incentives sought by 6 non-residential projects individually under $500,000, totaling $1,869,906 consistent with the approved Procedures; and

**RESOLVED**, that the proper Green Bank officers are authorized and empowered to do all other acts and execute and deliver any and all documents and regulatory filings as they shall deem necessary and desirable to effect the above-mentioned incentives consistent with the Procedures.

# Energy Storage Solution Program
# Upfront Incentive Application

| | |
|---|---|
| **Project Description** | Installation of a Tesla Megapack battery storage system of 13.74 power rating to peak demand ratio and 2,569 kW of power capacity to reduce electric bills and provide backup power to the facility during power outages. |

## Customer / Site information

| | |
|---|---|
| **Customer Name** | Hubbell Heater |
| **Address** | 45 Seymour St., Stratford, CT 06615 |
| **Business Purpose** | Manufacturing |
| **Incentive Application No.** | ESS-00159 |
| **Incentive Application Date** | 3/8/2022 |
| **Customer Peak Demand (kW)** | 187 |
| **Customer Class (S / M / L)** | Small |
| **Project Developer / Installer** | Enel X North America |

## 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** | Standalone |
| **Expected Program Participation** | Passive and Active Dispatch |
| **BESS Make / Model** | Tesla Megapack |
| **BESS Power Rating (kW)** | 2,569 kW |
| **BESS Energy Capacity (kWh)** | 5,139 kWh |
| **BESS Technology Approval Status** | Pre-Approved |
| **Power Rating to Peak Demand Ratio** | 13.74 |
| **Interconnection Application Filed** | No |
| **Interconnection Study Required** | Transmission and Distribution |
| **Estimated Project Cost** | $3,239,451.00 |

## Benefit / Cost Ratios

| | |
|---|---|
| **RIM – Ratepayer Impact Measure** | 1.00 |
| **PCT – Participant Cost Test** | 1.04 |
| **PACT – Program Administrator Cost Test** | 1.10 |
| **SCT – Societal Cost Test** | 0.80 |
| **TRC – Total Resource Cost Test** | 0.81 |

## Upfront Incentive Information

| | |
|---|---|
| **Incentive Application Status** | ▪ **Application Submitted**<br>▪ Approved Reservation of Funds Letter (ROF)<br>▪ Approved Confirmation of Funds Letter (COF) |
| **Incentive Calculation Method** | Tiered Incentive |
| **Estimated Upfront Incentive** | $598,917.00 |

# Energy Storage Solution Program
# Upfront Incentive Application

| | |
|---|---|
| **Project Description** | Installation of a Socomec Sunsys HES L battery storage system of 0.71 power rating to peak demand ratio and 500 kW of power capacity to reduce electric bills and provide backup power to the facility during power outages. |

**Customer / Site information**

| | |
|---|---|
| **Customer Name** | Nuovo Pasta Productions, LTD |
| **Address** | 1330 Honeyspot Rd. Ext., Stratford, CT 06615 |
| **Business Purpose** | Manufacturing |
| **Incentive Application No.** | ESS-00041 |
| **Incentive Application Date** | 1/21/2022 |
| **Customer Peak Demand (kW)** | 703 |
| **Customer Class (S / M / L)** | Large |
| **Project Developer / Installer** | QCells Enable |

**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 battery |
| **Expected Program Participation** | Passive and Active Dispatch |
| **BESS Make / Model** | Socomec Sunsys HES L |
| **BESS Power Rating (kW)** | 500 kW |
| **BESS Energy Capacity (kWh)** | 1,116 kWh |
| **BESS Technology Approval Status** | Pre-Approved |
| **Power Rating to Peak Demand Ratio** | 0.71 |
| **Interconnection Application Filed** | No |
| **Interconnection Study Required** | None |
| **Estimated Project Cost** | $1,115,512.00 |

**Benefit / Cost Ratios**

| | |
|---|---|
| **RIM – Ratepayer Impact Measure** | 1.12 |
| **PCT – Participant Cost Test** | 1.32 |
| **PACT – Program Administrator Cost Test** | 2.02 |
| **SCT – Societal Cost Test** | 1.77 |
| **TRC – Total Resource Cost Test** | 1.78 |

**Upfront Incentive Information**

| | |
|---|---|
| **Incentive Application Status** | ▪ **Application Submitted**<br>▪ Approved Reservation of Funds Letter (ROF)<br>▪ Approved Confirmation of Funds Letter (COF) |
| **Incentive Calculation Method** | Single Rate |
| **Estimated Upfront Incentive** | $111,600.00 |

# Energy Storage Solution Program
# Upfront Incentive Application

| | |
|---|---|
| **Project Description** | Installation of a Tesla Megapack battery storage system of 2.72 power rating to peak 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** | Eaton Corporation Pressure Sen. |
| **Address** | 15 Durant Ave., Bethel, CT 06801 |
| **Business Purpose** | Manufacturing |
| **Incentive Application No.** | ESS-00177 |
| **Incentive Application Date** | 3/15/2022 |
| **Customer Peak Demand (kW)** | 471 |
| **Customer Class (S / M / L)** | Medium |
| **Project Developer / Installer** | Enel X North America |

**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 Peak Demand Ratio** | 2.72 |
| **Interconnection Application Filed** | No |
| **Interconnection Study Required** | None |
| **Estimated Project Cost** | $1,615,269.00 |

**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**<br>▪ Approved Reservation of Funds Letter (ROF)<br>▪ Approved Confirmation of Funds Letter (COF) |
| **Incentive Calculation Method** | Tiered Incentive |
| **Estimated Upfront Incentive** | $331,800.00 |

# Energy Storage Solution Program
# Upfront Incentive Application

| | |
|---|---|
| **Project Description** | Installation of a Socomec SUNSYS HES L storage system of 0.37 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** | 5 McKee Place |
| **Business Purpose** | Transportation and Warehousing |
| **Incentive Application No.** | ESS-00179 |
| **Incentive Application Date** | 3/17/2022 |
| **Customer Peak Demand (kW)** | 676 |
| **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 on-site generation (Solar PV) |
| **Expected Program Participation** | Passive and Active Dispatch |
| **BESS Make / Model** | Socomec SUNSYS HES L |
| **BESS Power Rating (kW)** | 250 |
| **BESS Energy Capacity (kWh)** | 558 |
| **BESS Technology Approval Status** | Pre-Approved |
| **Power Rating to Peak Demand Ratio** | 0.37 |
| **Interconnection Application Filed** | Yes |
| **Interconnection Study Required** | None |
| **Estimated Project Cost** | $431,359.00 |

**Benefit / Cost Ratios**

| | |
|---|---|
| **RIM – Ratepayer Impact Measure** | 1.70 |
| **PCT – Participant Cost Test** | 0.92 |
| **PACT – Program Administrator Cost Test** | 2.23 |
| **SCT – Societal Cost Test** | 1.77 |
| **TRC – Total Resource Cost Test** | 1.78 |

**Upfront Incentive Information**

| | |
|---|---|
| **Incentive Application Status** | ▪ **Application Submitted**<br>▪ Approved Reservation of Funds Letter (ROF)<br>▪ Approved Confirmation of Funds Letter (COF) |
| **Incentive Calculation Method** | Tiered Rate |
| **Estimated Upfront Incentive** | $55,800.00 |

# Energy Storage Solution Program
# Upfront Incentive Application

| | |
|---|---|
| **Project Description** | Installation of a Tesla Megapack battery storage system of 2.02 power rating to peak demand ratio and 768 kW of power capacity to reduce electric bills and provide backup power to the facility during power outages. |

**Customer / Site information**

| | |
|---|---|
| **Customer Name** | Southington Water Treatment Plant |
| **Address** | 999 Meriden-Waterbury Turnpike, Southington, CT 06479 |
| **Business Purpose** | Water Treatment Plant |
| **Incentive Application No.** | ESS-00193 |
| **Incentive Application Date** | 3/24/2022 |
| **Customer Peak Demand (kW)** | 380 |
| **Customer Class (S / M / L)** | Medium |
| **Project Developer / Installer** | ConEdison Clean Energy Businesses |

**Program Eligibility**

| | |
|---|---|
| **Critical Facility** | Yes |
| **Small Business** | No |
| **Onsite Fossil Fuel Generator** | No |
| **Grid Edge Customer** | No |
| **Participation in FCM Allowed** | Yes |
| **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)** | 768 |
| **BESS Energy Capacity (kWh)** | 3,070 |
| **BESS Technology Approval Status** | Pre-Approved |
| **Power Rating to Peak Demand Ratio** | 2.02 |
| **Interconnection Application Filed** | No |
| **Interconnection Study Required** | None |
| **Estimated Project Cost** | $1,692,792.00 |

**Benefit / Cost Ratios**

| | |
|---|---|
| **RIM – Ratepayer Impact Measure** | 1.61 |
| **PCT – Participant Cost Test** | 0.88 |
| **PACT – Program Administrator Cost Test** | 2.12 |
| **SCT – Societal Cost Test** | 1.62 |
| **TRC – Total Resource Cost Test** | 1.64 |

**Upfront Incentive Information**

| | |
|---|---|
| **Incentive Application Status** | ▪ **Application Submitted**<br>▪ Approved Reservation of Funds Letter (ROF)<br>▪ Approved Confirmation of Funds Letter (COF) |
| **Incentive Calculation Method** | Tiered Incentive |
| **Estimated Upfront Incentive** | $456,902.00 |

# Energy Storage Solution Program
# Upfront Incentive Application

| | |
|---|---|
| **Project Description** | Installation of a Tesla Megapack battery storage system of 1.82 power rating to peak demand ratio and 768 kW of power capacity to reduce electric bills and provide backup power to the facility during power outages. |

**Customer / Site information**

| | |
|---|---|
| **Customer Name** | John F Kennedy Middle School |
| **Address** | 1071 S Main St., Southington, CT 06479 |
| **Business Purpose** | Educational Services |
| **Incentive Application No.** | ESS-00194 |
| **Incentive Application Date** | 3/24/2022 |
| **Customer Peak Demand (kW)** | 420 |
| **Customer Class (S / M / L)** | Medium |
| **Project Developer / Installer** | ConEdison Clean Energy Businesses |

**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 existing on-site generation |
| **Expected Program Participation** | Passive and Active Dispatch |
| **BESS Make / Model** | Tesla Megapack |
| **BESS Power Rating (kW)** | 768 |
| **BESS Energy Capacity (kWh)** | 3,070 |
| **BESS Technology Approval Status** | Pre-Approved |
| **Power Rating to Peak Demand Ratio** | 1.82 |
| **Interconnection Application Filed** | No |
| **Interconnection Study Required** | None |
| **Estimated Project Cost** | $1,692,792.00 |

**Benefit / Cost Ratios**

| | |
|---|---|
| **RIM – Ratepayer Impact Measure** | 1.61 |
| **PCT – Participant Cost Test** | 0.88 |
| **PACT – Program Administrator Cost Test** | 2.12 |
| **SCT – Societal Cost Test** | 1.63 |
| **TRC – Total Resource Cost Test** | 1.64 |

**Upfront Incentive Information**

| | |
|---|---|
| **Incentive Application Status** | ▪ **Application Submitted**<br>▪ Approved Reservation of Funds Letter (ROF)<br>▪ Approved Confirmation of Funds Letter (COF) |
| **Incentive Calculation Method** | Tiered Incentive |
| **Estimated Upfront Incentive** | $456,902.00 |

# Energy Storage Solution Program
# Upfront Incentive Application

| | |
|---|---|
| **Project Description** | Installation of a Tesla Megapack battery storage system of 1.70 power rating to peak demand ratio and 768 kW of power capacity to reduce electric bills and provide backup power to the facility during power outages. |

**Customer / Site information**

| | |
|---|---|
| **Customer Name** | Joseph DePaolo Middle School |
| **Address** | 385 Pleasant Street, Southington, CT 06489 |
| **Business Purpose** | Educational Services |
| **Incentive Application No.** | ESS-00195 |
| **Incentive Application Date** | 3/24/2022 |
| **Customer Peak Demand (kW)** | 450 |
| **Customer Class (S / M / L)** | Medium |
| **Project Developer / Installer** | ConEdison Clean Energy Business |

**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 existing on-site generation (Solar PV) |
| **Expected Program Participation** | Passive and Active Dispatch |
| **BESS Make / Model** | Tesla Megapack |
| **BESS Power Rating (kW)** | 768 |
| **BESS Energy Capacity (kWh)** | 3,070 |
| **BESS Technology Approval Status** | Pre-Approved |
| **Power Rating to Peak Demand Ratio** | 1.70 |
| **Interconnection Application Filed** | No |
| **Interconnection Study Required** | None |
| **Estimated Project Cost** | $1,692,792.00 |

**Benefit / Cost Ratios**

| | |
|---|---|
| **RIM – Ratepayer Impact Measure** | 1.61 |
| **PCT – Participant Cost Test** | 1.01 |
| **PACT – Program Administrator Cost Test** | 2.12 |
| **SCT – Societal Cost Test** | 1.63 |
| **TRC – Total Resource Cost Test** | 1.64 |

**Upfront Incentive Information**

| | |
|---|---|
| **Incentive Application Status** | ▪ **Application Submitted**<br>▪ Approved Reservation of Funds Letter (ROF)<br>▪ Approved Confirmation of Funds Letter (COF) |
| **Incentive Calculation Method** | Tiered Incentive |
| **Estimated Upfront Incentive** | $456,902.00 |

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CONNECTICUT GREEN BANK

# Memo

**To:** Connecticut Green Bank Board of Directors

**From:** Eric Shrago

**CC:** Bryan Garcia, Sergio Carrillo, and Mackey Dykes

**Date:** January 20, 2023

**Re:** Fiscal Year 2023 Progress to Targets and Activity in Vulnerable Communities through Q2

---

The following memo outlines Connecticut Green Bank (CGB) progress to targets[1] and capital deployed in vulnerable communities[2] for Fiscal Year (FY) 2023 as of December 31, 2022.

### Table 1. Incentive Programs FY 2023 Progress to Targets

| | Projects | | | Capital Deployed | | | Capacity (MW) | | |
|---|---|---|---|---|---|---|---|---|---|
| **Product/Program** | **Closed** | **Target** | **% to Target** | **Closed** | **Target** | **% to Target** | **Closed** | **Target** | **% to Target** |
| Battery Storage | 7 | 500 | 1% | $272,983 | $20,000,000 | 1% | 0.1 | 7.6 | 1% |
| Smart-E[3] | 648 | 960 | 68% | $11,904,407 | $14,994,623 | 79% | 0.1 | 0.2 | 53% |
| **Total Incentive Programs** | **655** | **1,460** | **45%** | **$12,177,390** | **$34,994,623** | **35%** | **0.2** | **7.8** | **2%** |

### Table 2. Incentive Programs FY 2023 Vulnerable Communities

| | Capital Deployed | | | |
|---|---|---|---|---|
| **Product/Program** | **Not Vulnerable** | **Vulnerable** | **Total** | **% Vulnerable** |
| Battery Storage | | | | |
| Smart-E | $7,235,681 | $4,668,726 | $11,904,407 | 39% |
| **Total Incentive Programs** | **$7,235,681** | **$4,668,726** | **$11,904,407** | **39%** |

[1] Power BI data source: https://app.powerbi.com/groups/289235dd-d77d-4043-8dae-d232a51a116a/reports/b24ec66b-a2c1-49f0-9a62-3f7443077b3f/ReportSection13c15e79a907a30b650e

[2] Power Bi data source: https://app.powerbi.com/groups/289235dd-d77d-4043-8dae-d232a51a116a/reports/dcec3754-1e52-4c0c-b579-cfa7df20379c/ReportSection3a1e4346c50856c3c008

[3] See Table 9 for current reporting periods for Smart-E lenders

### Table 3. Smart-E Channels

| Smart-E Loan Channels | Closed | % of Loans |
|---|---|---|
| Battery Storage | 3 | 0% |
| EV | 0 | 0% |
| Health and Safety | 2 | 0% |
| Home Performance | 43 | 7% |
| HVAC | 571 | 88% |
| Solar | 10 | 2% |
| (blank) | 19 | 3% |
| **Total** | **648** | **100%** |

### Table 4. Financing Programs FY 2023 Progress to Targets

| | Projects | | | Capital Deployed | | | Capacity (MW) | | |
|---|---|---|---|---|---|---|---|---|---|
| **Product/Program** | **Closed** | **Target** | **% to Target** | **Closed** | **Target** | **% to Target** | **Closed** | **Target** | **% to Target** |
| Commercial Lease | 4 | 19 | 21% | $1,396,539 | $13,710,000 | 10% | 1.3 | 7.6 | 17% |
| CPACE | 4 | 23 | 17% | $17,001,114 | $31,000,000 | 55% | 0.5 | 0.0 | 0% |
| SBEA | 442 | 839 | 53% | $7,840,295 | $18,600,000 | 42% | 0.0 | 0.0 | 0% |
| Multi-Family Health and Safety | 0 | 1 | 0% | $0 | $892,500 | 0% | 0.0 | 0.0 | 0% |
| Multi-Family Term | 0 | 6 | 0% | $0 | $1,380,000 | 0% | 0.0 | 0.6 | 0% |
| **Total Financing Programs** | **450** | **882** | **51%** | **$26,237,947** | **$64,202,500** | **41%** | **1.8** | **7.6** | **23%** |

### Table 5. Financing Programs FY 2023 Vulnerable Communities (excluding SBEA)

| | Capital Deployed | | | |
|---|---|---|---|---|
| **Product/Program** | **Not Vulnerable** | **Vulnerable** | **Total** | **% Vulnerable** |
| Commercial Lease | $4,244,155 | $12,756,959 | $17,001,114 | 75% |
| CPACE | $1,396,539 | $0 | $1,396,539 | 0% |
| SBEA | NA | NA | NA | NA |
| Multi-Family Health and Safety | $0 | $0 | $0 | $0 |
| Multi-Family Term | $0 | $0 | $0 | $0 |
| **Total Financing Programs** | **$5,640,694** | **$12,756,959** | **$18,397,653** | **69%** |

### Table 6. Multi-Family Units

| MFH # of Units | Closed |
|---|---|
| Affordable | 0 |
| Market Rate | 0 |
| **Total** | **0** |

### Table 7. CGB Totals FY 2023 Progress to Targets

| | Projects | | | Capital Deployed | | | Capacity (MW) | | |
|---|---|---|---|---|---|---|---|---|---|
| **Segment** | **Closed** | **Target** | **% to Target** | **Closed** | **Target** | **% to Target** | **Closed** | **Target** | **% to Target** |
| Incentive Programs | 655 | 1,460 | 45% | $12,177,390 | $34,994,623 | 35% | 0.2 | 7.8 | 2% |
| Financing Programs | 450 | 882 | 51% | $26,237,947 | $64,202,500 | 41% | 1.8 | 7.6 | 23% |
| **Total** | **1,098** | **2,342** | **47%** | **$38,142,354** | **$99,197,123** | **38%** | **1.9** | **15.4** | **12%** |

### Table 8. CGB Totals FY 2023 Vulnerable Communities (excluding SBEA)

| | Capital Deployed | | | |
|---|---|---|---|---|
| **Product/Program** | **Not Vulnerable** | **Vulnerable** | **Total** | **% Vulnerable** |
| Incentive Programs | $7,235,681 | $4,668,726 | $11,904,407 | 39% |
| Financing Programs | $5,640,694 | $12,756,959 | $18,397,653 | 69% |
| **Total** | **$12,876,375** | **$17,425,685** | **$30,302,059** | **57%** |

### Table 9. Current Reporting Periods for Smart-E Lenders

| **Lender** | **Current Reporting Period** |
|---|---|
| Capital For Change | 11/1/2022 |
| CorePlus Federal Credit Union | 12/1/2022 |
| Eastern Connecticut Savings Bank | 12/1/2022 |
| First National Bank of Suffield | 12/1/2022 |
| Ion Bank | 12/1/2022 |
| Liberty Bank | 12/1/2022 |
| Mutual Security Credit Union | 12/1/2022 |
| Nutmeg State Financial Credit Union | 11/1/2022 |
| Patriot Bank | 12/1/2022 |
| Quinnipac Bank & Trust | NULL |
| Thomaston Savings Bank | 12/1/2022 |
| Union Savings Bank | 12/1/2022 |
| Workers Federal Credit Union | 12/1/2022 |

CONNECTICUT
GREEN BANK®


# Solutions for Connecticut.
# A Model for the Nation.

2022 Annual Report

# Connecticut serves as a model for the nation

MESSAGE FROM THE PRESIDENT & CHIEF EXECUTIVE OFFICER

Bryan Garcia, President and CEO

*"The civilization of New England has been like a beacon lit upon a hill, which, after it has diffused its warmth around, tinges the distant horizon with its glow." -- From "Democracy In America" (1835) by Alexis de Tocqueville, French sociologist and political theorist*

When de Tocqueville visited this young nation in the 1830s, he remarked that the principles of folks living in New England had a tendency to spread, "at first to the neighboring states" and then beyond. He recognized the importance of civic engagement and the role of states like Connecticut. Known as the Constitution State because the world's first written constitution was created here in 1639, Connecticut has a rich history when it comes to Democracy, clean energy, and climate change. (You can read more about our heroes on page 17 and about our inspiration to democratize investments at www.greenlibertybonds.com.)

The Connecticut Green Bank is just one recent example. Created through a bipartisan act of legislation in 2011, we have mobilized nearly $2.3 billion by investing public funds to attract private investment at seven-to-one ratio. This has helped create thousands of jobs, reduced energy costs for thousands of families, businesses, and communities, and limited greenhouse gas emissions that harm public health.

Our focus includes a goal of directing no less than 40 percent of investment and benefits from our programs into vulnerable communities that are disproportionately impacted by the effects of climate change by 2025. We do this because our vision for a planet protected by the love of humanity reflects an unwavering commitment to and incessant hope for the betterment of our communities and country.

Many exciting leadership moments have occurred since our last annual report.

## Table of Contents



**Launch of Energy Storage Solutions.** In January, the Energy Storage Solutions (ESS) program was launched, with us as a co-administrator. Through the guidance of the Public Utilities Regulatory Authority (PURA), this upfront and performance-based incentive program will drive the deployment of 580 MW of battery storage for residential and non-residential customers. This will reduce peak demand (lowering electric rates for everyone) while providing an opportunity to increase resiliency in the face of grid disruptions, particularly for those in low-income and distressed communities. This is one of the most ambitious battery deployment programs in the nation. (See page 9)

**Clean energy goals reached.** The Residential Solar Investment Program (RSIP) officially achieved its 350 MW public policy deployment target, reaching over 46,000 households, mobilizing over $1.4 billion of public and private investment, and helping create over 16,000 jobs in our communities. RSIP made Connecticut the most successful residential solar PV deployment market in the entire Northeast on a watts per capita basis, and most likely at the lowest level of ratepayer incentives – setting the state up for success as the market transitions from RSIP and net metering to a tariff-based form of compensation.

**Creating more opportunities for investment.** Building upon the success of our Green Liberty Bonds, we launched our Green Liberty Notes. These one-year term verified green bonds allow anyone to invest with as little as $100. Through four offerings, and two sell-outs, we've raised more than $800,000 from investors across the country who are supporting Connecticut small businesses that are investing in energy efficiency improvements within their buildings. (See page 10)

**Inflation Reduction Act (IRA) and inclusion of National Climate Bank (NCB).** In August, the U.S. Congress passed and President Biden signed the historic IRA, which included billions of dollars in investments to advance the country's clean energy transition and fight climate change. We are proud to serve as the model for its Greenhouse Gas Reduction Fund (a.k.a., National Climate Bank). We are hard at work making plans to leverage these funds to increase and accelerate investment in our green economy to improve the lives of residents and the operations of businesses in our state, especially those in vulnerable communities.

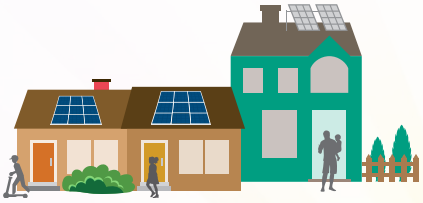
We also continue to track our performance against our E4 metrics, and are deep in the planning efforts around our enhanced scope that now includes environmental infrastructure (See page 14).

New England's beacon continues to glow.

# our solutions

The Green Bank is helping Connecticut flourish by offering green solutions for homes and buildings, and by creating innovative ways to invest in the green economy.

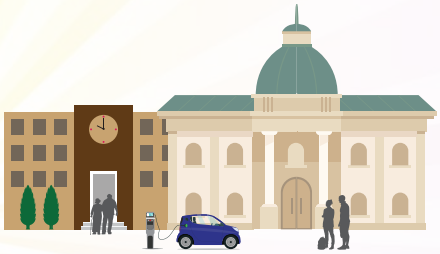
## home solutions



## building solutions

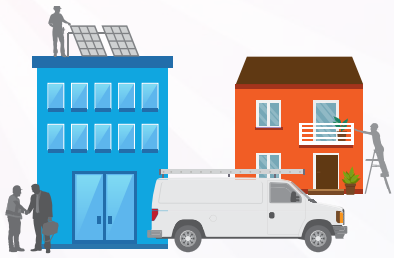
## investment solutions


## community solutions



## energy storage solutions


## contractor solutions



Our mission is to confront climate change by increasing and accelerating investment into Connecticut's green economy to create more resilient, healthier, and equitable communities. Established in 2011 as a quasi-public agency, the Green Bank uses limited public dollars to attract private capital investment and offers green solutions that help people, businesses and all of Connecticut thrive.

Guiding this mission is our vision for "...a planet protected by the love of humanity."

# highlights & milestones

In FY 2022, our eleventh year of operation, the Green Bank continued to achieve new successes in our financing and incentive businesses while facing challenges created by global concerns (pandemic, war in Ukraine, trade disputes) and local factors such as policy changes and new programs.

**Success of the Residential Solar Investment Program (RSIP)** — The RSIP surpassed its public policy target of 350 megawatts of solar deployment one-year ahead of schedule, with more $1.4 billion of investment and more than 46,000 homes adding solar. The program has ensured equitable access for low-to-moderate income families making Connecticut a "solar with justice" state. This was achieved primarily through the Solar for All partnership with PosiGen. (See page 11).

**Introducing Green Liberty Notes** – In January, we launched our Green Liberty Notes as a follow-on to the award-winning Green Liberty Bonds. These Notes allow anyone to invest with a minimum of $100 to earn a competitive return and support small business energy efficiency in Connecticut. Through four offerings, we have raised more than $800,000, and are planning four offerings in 2023. (See page 10).

**Creation of the Greenhouse Gas Reduction Fund** - After over a decade of advocacy and demonstrating the efficacy of the green bank model at the local and state levels across the country, Congress passed and President Biden signed the Inflation Reduction Act (IRA), which included the $27 billion Greenhouse Gas Reduction Fund (GHGRF). Modeled after, in large part, the Connecticut Green Bank, the GHGRF will provide $7 billion in competitive grants, loans and other forms of financial and technical assistance for zero emission technologies to low-income and disadvantaged communities, and $20 billion for a national climate bank that includes green banks, community development financial institutions, and other non-profits focused on avoiding and reducing GHG emissions and air pollution.

## introducing Energy Storage Solutions

In January 2022, the Energy Storage solutions program was launched. Under the guidance of PURA, the Green Bank will serve as co-administrator of the program, which is designed to leverage upfront and performance-based incentives to encourage the installation of residential and non-residential battery storage systems. (See page 9)

**Environmental Infrastructure** – With the passage of Public Act 21-115 in 2021 that expanded our scope, we initiated efforts to better understand how the green bank model for clean energy could apply to environmental infrastructure. We amended our governance documents to incorporate the legislative scope expansion, investigated the capabilities of our Green Liberty Bonds to raise capital (including 50-year bonds), engaged with stakeholders across the environmental infrastructure spectrum, held a strategic retreat, and put forth a Comprehensive Plan to set a course for implementing this scope expansion. (See page 14).

# by the numbers

FY12
FY22

Since the Connecticut Green Bank's inception through the bipartisan legislation in July 2011, we have mobilized more than $2.26 billion of investment into the State's green economy. To do this, we used $322.4 million in Green Bank dollars to attract $1.95 billion in private investment, a leverage ratio of $7.00 for every $1. The impact of our deployment of renewable energy and energy efficiency to families, businesses, and our communities is shown in terms of economic development, environmental protection, equity, and energy (data from FY 2012 through FY 2022).

## ECONOMIC DEVELOPMENT

**JOBS** The Green Bank has supported the creation of more than **26,720** direct, indirect, and induced job-years.

**TAX REVENUES**
The Green Bank's activities have helped generate an estimated **$113.6** million in state tax revenues.

**$55.3 million** individual income tax

**$29.2 million** corporate taxes

**$29.1 million** sales taxes

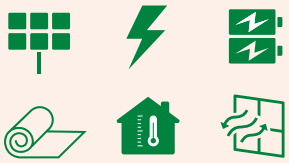
## ENERGY

**ENERGY BURDEN**
The Green Bank has reduced the energy costs on families, businesses, and our communities.

**60,000+**
*families*

**6,500+**
*businesses*

**DEPLOYMENT**
The Green Bank has accelerated the growth of renewable energy to more than **509 MW** and lifetime savings of over **65.6 million MMBTUs** through energy efficiency projects.



## ENVIRONMENTAL PROTECTION

**POLLUTION** The Green Bank has helped reduce air emissions that cause climate change and worsen public health, including **9.6** million pounds of SOx and **11.1** million pounds of NOx lifetime.

**10.4 MILLION tons of $CO_2$ : EQUALS**

**156 MILLION** tree seedlings grown for 10 years

**OR**

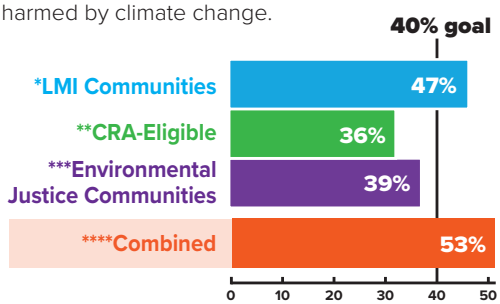
**2.1 MILLION** passenger vehicles driven for one year

**PUBLIC HEALTH** The Green Bank has improved the lives of families, helping them avoid sick days, hospital visits, and even death.

**$317.1 – $717.2 million of lifetime public health value created**

## EQUITY

**INVESTING** in vulnerable communities, The Green Bank has set **goals** to reach **40% investment** in communities that may be disproportionately harmed by climate change.




*LMI Communities – census tracts where households are at or below 100% Area Median Income.

**Community Reinvestment Act (CRA) Eligible – households at or below 80% of Area Median Income and all projects in programs designed to assist LMI customers.

***Environmental Justice Community means a municipality that has been designated as distressed by Connecticut Department of Economic and Community Development (DECD) or a census block group for which 30% or more of the population have an income below 200% of the federal poverty level.

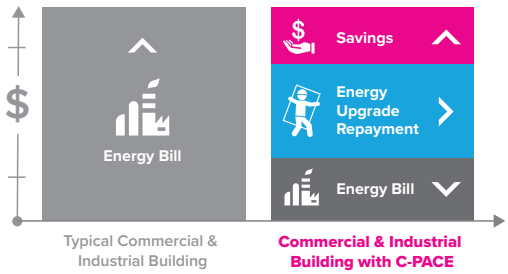
****Combined Vulnerable Communities include LMI, CRA and EJC.

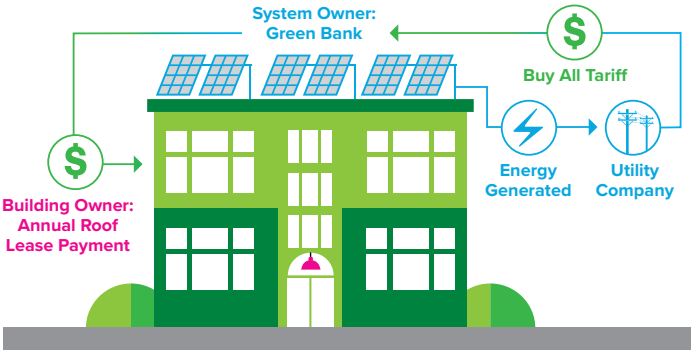
# building solutions


More modern, sustainable buildings means more comfortable environments for workers and customers, and better bottom lines for building owners. As utility costs continue to grow and strain operating budgets, renewables and energy efficiency will remain top of mind.

## The impact of c-pace and solar PPAs

Commercial Property Assessed Clean Energy (C-PACE) continues to be a unique source of financing for building owners making energy efficiency improvements or adding renewable energy sources. The total number of C-PACE projects has surpassed 369, including properties ranging from industrial facilities to retail and houses of worship. These projects have a total investment of $245,986,089, with Green Bank investment of $59,957,895, and private investment of $186,028,195, a leverage ratio of 4 to 1. The majority of this investment (71%) has been in vulnerable communities. Thanks to C-PACE financing, the lifetime cost savings to building owners is more than $312,641,00. Solar PPAs (power purchase agreements) also continue their impact for building owners. With nearly 200 total PPAs in place at the end of June, these owners are cumulatively seeing more than $3.2 million in annual utility savings.



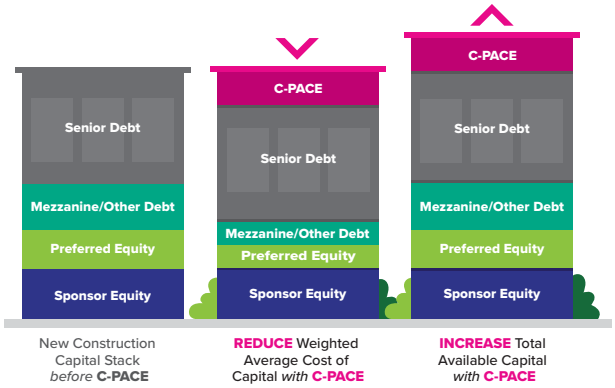




## A new option for going solar: lease your roof

Adding a solar PV system to a commercial or nonprofit building is a great way to help control electricity costs. In 2022, we added a new option for building owners looking to go solar: the roof lease. This allows an unused roof to become a worry-free revenue-producer as the Green Bank manages the solar system, pays the building owner, and the additional solar put more renewable energy into the utility grid leading to a healthier future for all.

## Enhanced tool for new construction financing

In April, we announced enhancements designed to create more opportunities for developers with new construction, repositioning, and gut rehabilitation projects. Developers and borrowers can access up to 35 percent of the total eligible construction costs in C-PACE financing based on the building's designed energy performance. This unlocks typically lower cost capital than other types of debt and equity, generally reducing the overall cost of capital, and producing buildings that meet higher energy efficiency standards.



# customer stories

**For more than 45 years, DiMare Pastry Shop in Stamford,** has been bringing sunshine into their customers' lives with their specialty baked goods. Started by Ugo and Bice DiMare in 1976, DiMare Pastry expanded to a second location in Stamford in 1997. Both locations are now run by three generations, including Ugo and Bice's daughters Maria and Sabrina and granddaughter Brittany. As their business has grown, energy costs have continued to rise. In 2020, they made the sweet decision to go solar using C-PACE financing, allowing the family business to reduce the burden of energy costs now and for many years to come.

**Energy Upgrade:** **75.8 kW** roof mounted solar photovoltaic system

**C-PACE Financing:**
**$246,000** over 20 years

**Projected Energy Savings:**
**$400,000** over the life of the upgrades

"We are always so busy and focused on serving our customers. We don't have time to think about rising energy costs. Going green with our new solar system takes some of the pressure off our business by giving us lower energy costs. We're proud to be doing the right thing for the environment too. We want to keep baking, delighting our customers and continuing on as a long-standing partner with the towns we serve."

*Maria DiMare*

**For over 70 years the L.C. Doane Company in Ivoryton CT,** has served the United States Navy and Coast Guard supplying lighting products. Since 2008, the facility has used solar photovoltaics on their roof to supply electricity to their 150,000 square foot factory. Thanks to C-PACE financing through the Green Bank, they are expanding their solar system to generate more energy to power their machinery, while saving money on their operations.

**Energy Upgrade:** **200 kW** roof mounted solar photovoltaic system

**C-PACE Financing:**
**$1.06** million over 10 years

**Projected Energy Savings:**
**$1.47** million over the life of the upgrades

"As a government subcontractor in the defense industry, it is essential to keep our own lights on. While manufacturing occurs under our roof, the power source is created from above. Our solar panels provide us with clean energy right on-site... Another level of U.S.-made, environmentally conscious manufacturing. As we continue to expand, so does our roof!"

*Bill Psillos, Vice President*

*Photos taken by Red Skies Photography*

**In 2019, property owner and former owner of Stencil Ease,** Brian Greenho wanted to make an environmentally conscious decision to reduce reliance on fossil fuels. Located in Old Saybrook, they are now the largest specialty stencil manufacturing company in the United States using sunshine to make stencils, and can ship any of 55,000 items anywhere in the world in 24-48 hours.

**Energy Upgrade:** **72 kW** roof mounted solar photovoltaic system

**C-PACE Financing:**
**$215,000** over 20 years

**Projected Energy Savings:**
**$400,000** over the life of the upgrades

"Since energizing our solar system 2.5 years ago we have generated more than 200 megawatt hours of clean energy. This roof-top solar system not only saves our tenant money annually it also helps put solar energy back onto the state grid during peak demand periods. As energy costs continue to increase YOY the value of our system becomes more relevant."

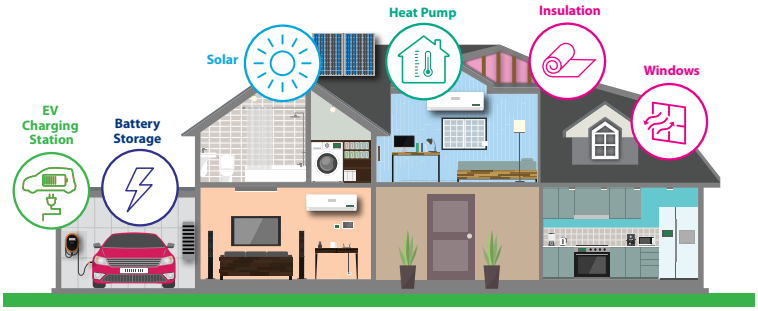
*Brian Greenho, Property Owner and former owner of Stencil Ease*

# home solutions

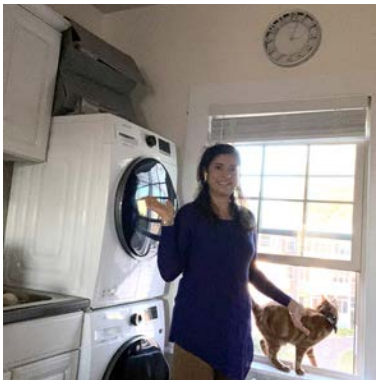
The Green Bank empowers Connecticut families through accessible and affordable green solutions that provide comfort and security. The Smart-E Loan was designed to make it easy and affordable for homeowners to make energy efficiency and clean energy improvements to their homes with no out-of-pocket cash and at interest rates low enough and repayment terms long enough to make the improvements "cash flow positive."

### Smart-E Loan

More than 900 homeowners took advantage of Smart-E financing in 2022, which is made available through a network of local lenders and contractors. Since 2014, more than 6,300 home energy improvement projects have been completed using Smart-E. These upgrades are estimated to produce lifetime cost savings of more than $80 million for the homeowners. The Smart-E loan provides financing for more than 40 improvement measures, including heat pumps, insulation, windows, battery storage, and solar.




## customer stories



"When I purchased my co-op unit in January 2020, I knew that I would have to create a savings plan to replace the 100-year-old-original windows that were in the apartment," said Astrid, who lives in Bridgeport. "However, with the pandemic and unexpected expenses, the plan for replacing the windows was moved further and further in the future while my family and I were spending all of our time at home with very deteriorated windows."

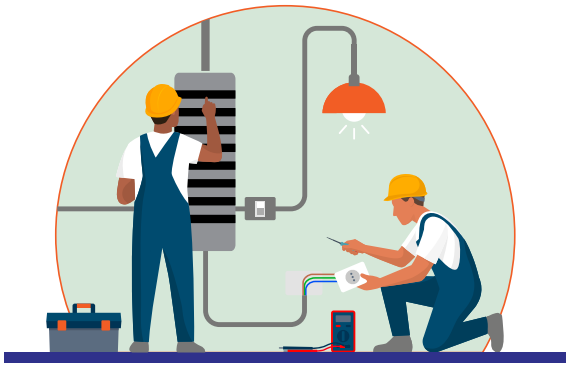
"I am very pleased to have found the Smart-E Loan through the Green Bank as it made possible that our 13 windows were fully replaced. Additionally, we learned that our dryer could be upgraded to an energy-efficient unit and the low-interest loan would cover it as well, so we did it."

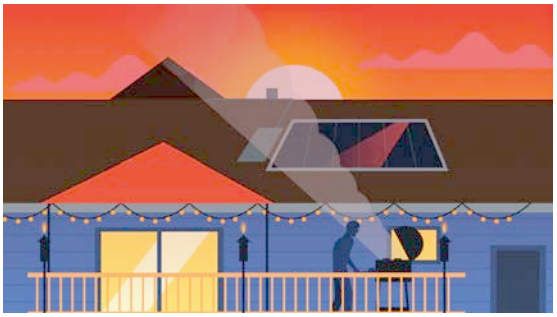
"It was simply a matter of following their process and they were able to walk us though each step and answer all of our questions. We are now happier to stay at home and enjoy a truly comfortable space. We can even open our windows!"

"I can't imagine an easier process to obtain a Smart-E Loan to install a new heat pump and replace my old AC units at my house," said Mike, a resident of Madison. "On top of that, the communication and professionalism from the amazing folks that run this program was stellar. No wonder this program came so highly recommended by the Heating & AC company that installed my units! I'm so grateful that this program is available to the residents of Connecticut as now my family is enjoying a cool/dry house in the hot summer months that is extremely energy efficient for an affordable and low interest monthly payment."

# introducing energy storage solutions

energy storage SOLUTIONS





In the face of our changing climate, solutions are needed that help our homes and businesses become resilient. To this end, in January 2022, the Public Utilities Regulatory Authority (PURA) launched Energy Storage Solutions. This new program was designed to incentivize Eversource and UI customers to install energy storage at their home or business.

This nine-year program has a goal of deploying 580 megawatts of electric storage by 2030. This will create a more reliable energy grid for everyone, especially vulnerable communities and those hit hardest by storm-related outages. Though they work great on their own, pairing batteries with solar photovoltaic (PV) systems can ensure that you can not only use power during an outage, but also recharge them when the sun comes out.

The key program elements include a declining-block upfront incentive, which is administered by the Green Bank, and a performance-based incentive (PBI), managed by Eversource and UI. The upfront incentive helps reduce the cost of installing a battery. Initially, the average residential customer will be eligible for an upfront incentive of around $200 per kilowatt-hour (kWh) of battery capacity, with a maximum incentive per project of $7,500. The PBI is paid out to customers seasonally depending on the average power the battery contributes to the grid during critical periods of peak demand.

During the first half of fiscal year 2022, the Green Bank worked with its administrative partners to design the program, including the enrollment process for customers, contractors and manufacturers; technology eligibility requirements; and the application and approval process.

Interest in the program is strong, especially among homeowners with solar on their roofs. By June 30, 2022, 23 projects had been approved (21 residential projects and two commercial and industrial (C&I) projects) totaling over 5,636 kWh of energy capacity. An additional 109 projects have applied to the program (76 residential, 33 C&I), totaling 172,011 kWh of energy capacity.

To learn more, please visit www.energystoragect.com.

# investment solutions


The Green Bank helps Connecticut thrive by creating opportunities for in-state residents and beyond to participate in our green investment solutions, earning a return on investment that support climate goals or unlocking financing for projects.

## Investment opportunities open to all

We are dedicated to encouraging more people to invest in the green economy. Starting in 2020 with the launch of our Green Liberty Bonds that sold out, we knew there was demand for more investment opportunities, and have aimed to lower the minimum investment amount from $1,000.

In January, our subsidiary launched Green Liberty Notes as a follow-on to the award-winning Green Liberty Bonds. With a minimum investment of $100, nearly anyone can earn a competitive return on a one-year maturity note and support small business energy efficiency in Connecticut.

With four offerings in the books, we have raised more than $800,000, with the majority of investments being $1,000 or less. While most investors live in Connecticut, more than 30 other states are represented including Alaska and Hawaii.

These offerings are made possible through a partnership with Raise Green, a climate tech marketplace for local impact investing based in Massachusetts.


We are pleased to see repeat investors and familiar names across our state, as well as a growing number of new investors with each offering. Quarterly offerings are planned for 2023.

Learn more and sign up for notifications at www.greenlibertynotes.com.

## Green Liberty Bond program wins CESA Award

In June, the Green Bank's Green Liberty Bond program was recognized as a recipient of the 2022 State Leadership in Clean Energy (SLICE) Awards from Clean Energy States Alliance (CESA) for "interesting, innovative, and highly creative way to generate revenue for clean energy projects." CESA is a national nonprofit coalition of public agencies working together to advance clean energy. The six winners, chosen by an independent panel of judges, were evaluated on leadership, innovation, cost-effectiveness, and replicability.

The first issuance of the Green Liberty Bonds in July 2020 sold nearly $17 million, and the second issuance in May 2021 sold nearly $25 million with over $98 million of orders placed from a broad array of investors, including retail investors across the U.S. Both bonds are Climate Bond Certified and rated "A+" by S&P.

*Pictured are, from left to right, Connecticut Green Bank staff Sergio Carrillo, Director of Incentive Programs; Sara Harari, Associate Director of Innovation and Strategic Advisor to the President & CEO; Emily Basham, Senior Manager of Partnership Development; and Warren Leon, Executive Director of the Clean Energy States Alliance.*

The bonds are backed by a unique revenue stream created by the sale of Solar Home Renewable Energy Credits (SHRECs), which are generated by solar panels on homes.

The Green Bank was also a SLICE Award winner in 2018 for the Solar for All program, in 2016 for the CT Solar Lease Commercial PPA program, and in 2014 for C-PACE.

## Budderfly receives $5 million in financing to expand through Capital Solutions Open RFP

In June, the Green Bank announced the closing of $5 million in secured loan facilities to support the market expansion of Connecticut-based Budderfly, which helps franchises and other businesses improve their energy efficiency, lowering their operating costs. Budderfly has provided its energy and cost saving services to roughly 100 Connecticut businesses, primarily quick service restaurants, convenience stores, and healthcare facilities, and will use the loan to continue to expand its Connecticut customer base. Budderfly built its business around the goals of saving money and lowering carbon emissions for small and medium-sized businesses by providing energy-saving equipment for its customers, assuming responsibility for logistics, up-front capital, and other associated risks for the business owners it serves.

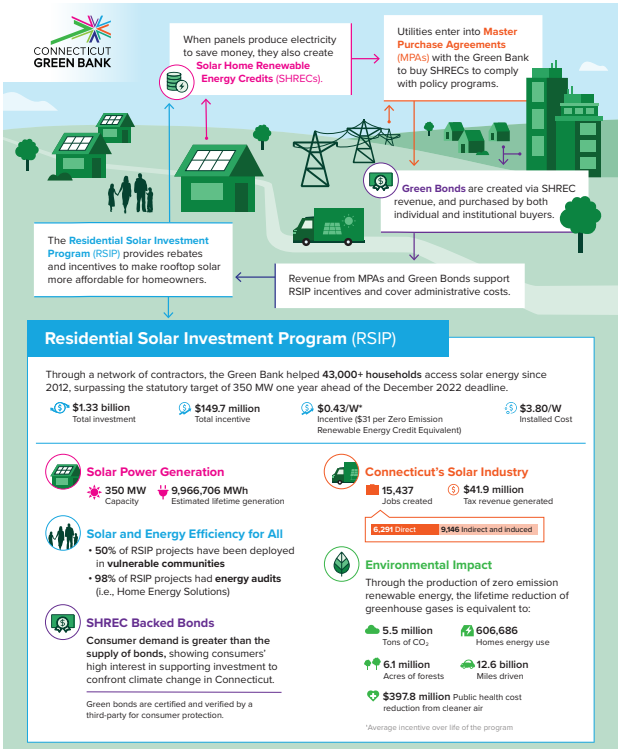
The company was awarded the funding through the Green Bank's Capital Solutions Open RFP, which is open to companies and technologies that have proven commercially viable or have strong business models, with the ability to rapidly achieve sustainable impact at scale.

## Connecticut becomes a "solar with justice" state thanks to RSIP and Solar For All

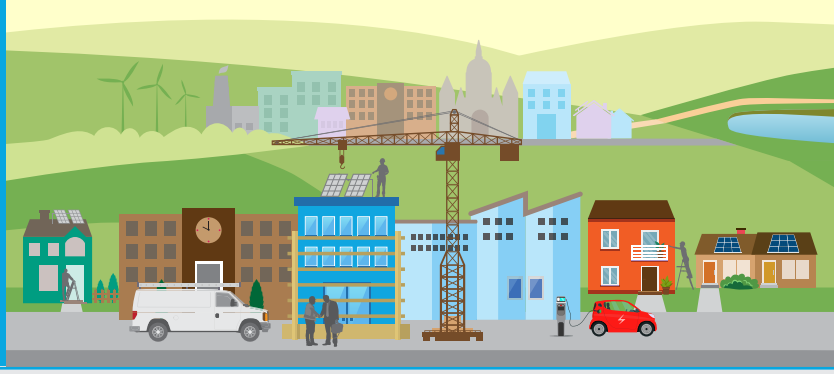
The Residential Solar Investment Program (RSIP) surpassed its public policy target of 350 megawatts of solar deployment one-year ahead of schedule. In reaching this level of deployment, we reached over 46,000 households (including the most vulnerable communities), mobilized over $1.4 billion of public and private investment (including about $160 million of ratepayer incentives – at an average equivalent ZREC price of $30), and helped create over 16,000 jobs in our communities.

The RSIP made Connecticut the most successful residential solar PV deployment market in the entire Northeast (i.e., New England, New Jersey, and New York) on a watts per capita basis, and most likely at the lowest level of ratepayer incentives – both effective and efficient.

The Solar For All program helped to ensure equitable access for low-to-moderate income families making Connecticut a "solar with justice" state. (Visit our website's Strategy & Impact section to see this full graphic and more on the program.)



# contractor solutions



## seventh annual awards presented

In recognition of their contributions to the deployment of clean energy and demonstrated leadership in their industries in 2021, the Green Bank recognized key partners among the dedicated network of contractors, developers, lending partners, community leaders and home- and building-owners. The 2021 awards recognized 27 contractors who are offering Green Bank's Home or Building Solutions and are performing at a high level and developing outstanding projects.

### C-PACE Outstanding Project *Recipient:* **Redevelopment project on Park Road in West Hartford.**


This project is an outstanding example of the ability of Commercial Property Assessed Clean Energy (C-PACE) financing to support the redevelopment of historic properties. This $70 million project received $13.7 million in C-PACE financing from CastleGreen Finance, LLC (a C-PACE capital provider and an affiliate of X-Caliber Capital), supporting the conversion of a 135-year-old convent to a 292-unit multi-family housing complex, allowing the Sisters of St. Joseph of Chambéry to remain in their home. The project, developed by Lex-Laz West Hartford, LLC, an affiliate of Lexington Partners LLC, was also made possible by Martin Kenny and Alan Lazowski, the Town of West Hartford and Liberty Bank. The project is the largest C-PACE project closed in the State of Connecticut to date.

### Solar PPA Outstanding Project

*Recipient:* **Solar installation at Ridgefield High School.**

The Green Bank honors Con Edison Solutions and the Ridgefield Board of Education for their 319.95 kW solar installation at Ridgefield High School. The solar system was installed through a Power Purchase Agreement (PPA) which is producing electricity and is estimated to help Ridgefield achieve more than $450,000 in savings over the 20 year-term. This is the fourth project the Town of Ridgefield has developed in partnership with the Green Bank.

### RSIP Top Local Performer

*Recipient:* **Earthlight**

Connecticut-based installer Earthlight had more than a MW of solar PV approved in 2021 through the RSIP. With 2.4 MW, Ellington-based Earthlight has demonstrated that local installers are continuing to grow their business with residential solar. Earthlight has participated in the RSIP since 2013 and has grown into one of Connecticut's largest local installers of residential solar PV. Since 2013, Earthlight has installed a total of 1,380 projects for 13.6 MW of capacity.

### RSIP Top Newcomer

*Recipient:* **Green Power Energy**

In only their second year in the Residential Solar Investment Program (RSIP), Green Power Energy installed more than 1 megawatt (MW) of solar PV systems in 2021 through the program. Since entering the state's residential market in 2020, they have quickly grown into one of the highest volume residential solar PV contractors in Connecticut. Green Power Energy recently opened a Connecticut location in Durham with a staff of 15. Since 2020, Green Power Energy has installed a total of 212 projects for 2.5 MW of capacity.

### Smart-E Loan Top Performer

*Recipients:*

- 20/20 Air Mechanical (New Milford)
- Absolute Air Services LLC (Portland)*
- Advanced Heating and Air Conditioning (South Windsor)
- Aiello Home Services LLC (Windsor Locks)
- Benvenuti Oil (Waterford)*
- Busy Bee Services (Burlington)
- Campbell Cooling LLC (Newington)
- Celco Heating and Air Conditioning (Bridgeport)
- Deitch Energy LLC (Hartford)
- Ductworks HVAC Services (Southington)
- Energy Unlimited, LLC (Bolton)*
- Glasco Heating & Air Conditioning Inc. (South Windsor)*
- Highland Window Co. (West Hartford)*
- Home Comfort Heating and Cooling Solutions, LLC (East Haven)*
- Homestead Fuel, Inc. (Ellington)*
- Link Mechanical Services Inc. (New Britain)*
- Nutmeg Mechanical Services, Inc. (Manchester)*
- Omni Mechanical Services (South Windsor)
- R&W Heating Energy Solutions LLC (Salem)*
- Ralph Mann & Sons Inc. (Ansonia)*
- Ryan F. Murphy Heating & Cooling LLC (New Milford)*
- Service Stars (Danbury)
- SolvIt, Inc. (Plainville)*
- Viglione Heating & Cooling Inc. (East Haven)*

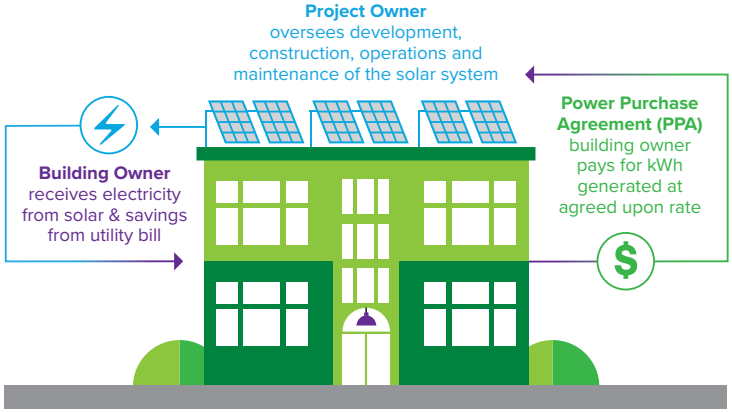
*The 2021 Top Performers listed in alphabetical order;*
** denotes 2020 Top Performer recognition*

# community solutions

Municipal and state buildings have options for going solar with no money down. The Green Bank Solar PPA (power purchase agreement) delivers immediate savings on electricity through a third-party owned and operated solar system, while the Solar Roof Lease allows property owners to generate income by leasing their roof space for the Green Bank and its partners to install solar.

## providing a (Solar) MAP for municipalities

In 2020, the Green Bank introduced the Solar Municipal Assistance Program (MAP), to make it easier for municipalities to access renewable energy and achieve energy savings at their buildings. Solar MAP provides technical assistance through every step of the process so towns and cities can realize all the cost-saving benefits of going solar with fewer challenges and roadblocks. Through the PPA, the municipality purchases the electricity generated by the solar array, and locks in low electricity cost so the cash flow is positive in year one.




The first round of Solar MAP municipalities included Manchester, Mansfield, Portland, and Woodbridge, and their solar projects are going online in early 2023.

## dedication of unique microgrid on the Daughters of Mary campus

In September, a one-of-a-kind microgrid was switched on to power four critical community facilities at the Daughters of Mary of the Immaculate Conception campus in New Britain. The project was named in honor of the late Mother Mary Jennifer Carroll, who first led the Order down the path of sustainable energy development five years ago with a C-PACE financed solar system that is integrated into the microgrid.

The innovative design of this $7 million project combines 1.4 megawatt hours of battery storage capacity with a total of 1.2 megawatts of solar generation. This ensures that the Daughters can provide social services and senior care during emergencies that threaten the local electric grid. This project utilized funding provided by a grant from the State administered by the Connecticut Department of Energy and Environmental Protection (DEEP) in the amount of $3.9 million, the largest-of-its-kind for microgrid development to be completed.

*Pictured at the dedication ceremony, from left to right, are former U.S. Rep. Joseph Kennedy III, Managing Director at Citizens Energy Corporation, New Britain Mayor Erin Stewart, Mother Superior Mary Janice Zdunczyk, Don Wingate, Vice President, Utility and Microgrid Solutions at Schneider Electric, and Bryan Garcia, President and CEO of the Green Bank. (Photo courtesy of Citizens Energy / Hannah Goetz)*

# environmental infrastructure plans

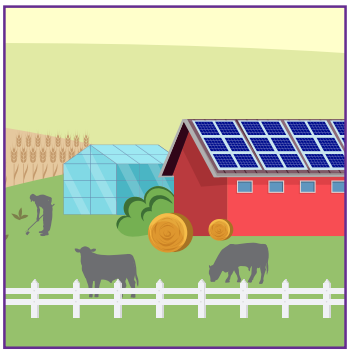
### scope expansion

In July 2021, the signing of Governor Lamont's House Bill 6441, with bipartisan support, advanced the green bank model to include environmental infrastructure, which encompasses 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 such as carbon offsets and ecosystem services.

**Environmental Markets**

**Land Conservation**

**Parks and Recreation**



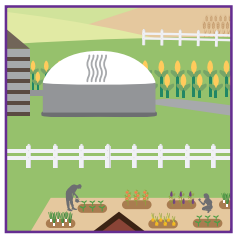
**Agriculture**

Since the scope expansion, our team has been meeting with key stakeholders to discuss environmental infrastructure, gathering information about their existing policies, programs, resources, and goals, as we create a comprehensive plan for addressing these subsectors.

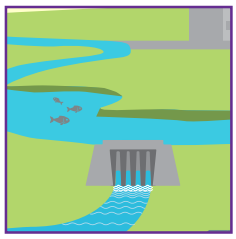
The outcomes of this research is twofold. A series of environmental infrastructure primers have been created to reflect the observations, findings, and initial recommendations from the conversations with stakeholders and research conducted on these topics. Primers on agriculture, land conservation, and parks and recreation are currently available in the "planning" section of our website, with primers on the other sectors to follow.

The second outcome of these stakeholder conversations is a more clear definition of the qualifications, experience, skills, and personality of the candidates to be considered for the new director of environmental infrastructure programs. The search, which began in the summer of 2022, will find the person who will be tasked with designing, implementing, and overseeing new programs to raise revenues to deploy environmental infrastructure in the state with a focus on decarbonization and climate resilience.

With the recent passage of the Inflation Reduction Act, and its inclusion of the Greenhouse Gas Reduction Fund, alongside the Green Bank's ability to issue 50-year Green Liberty Bonds for environmental infrastructure, the incoming Director will have resources to mobilize private investment in Connecticut's growing green economy, especially in Community Reinvestment Act eligible and environmental justice communities.

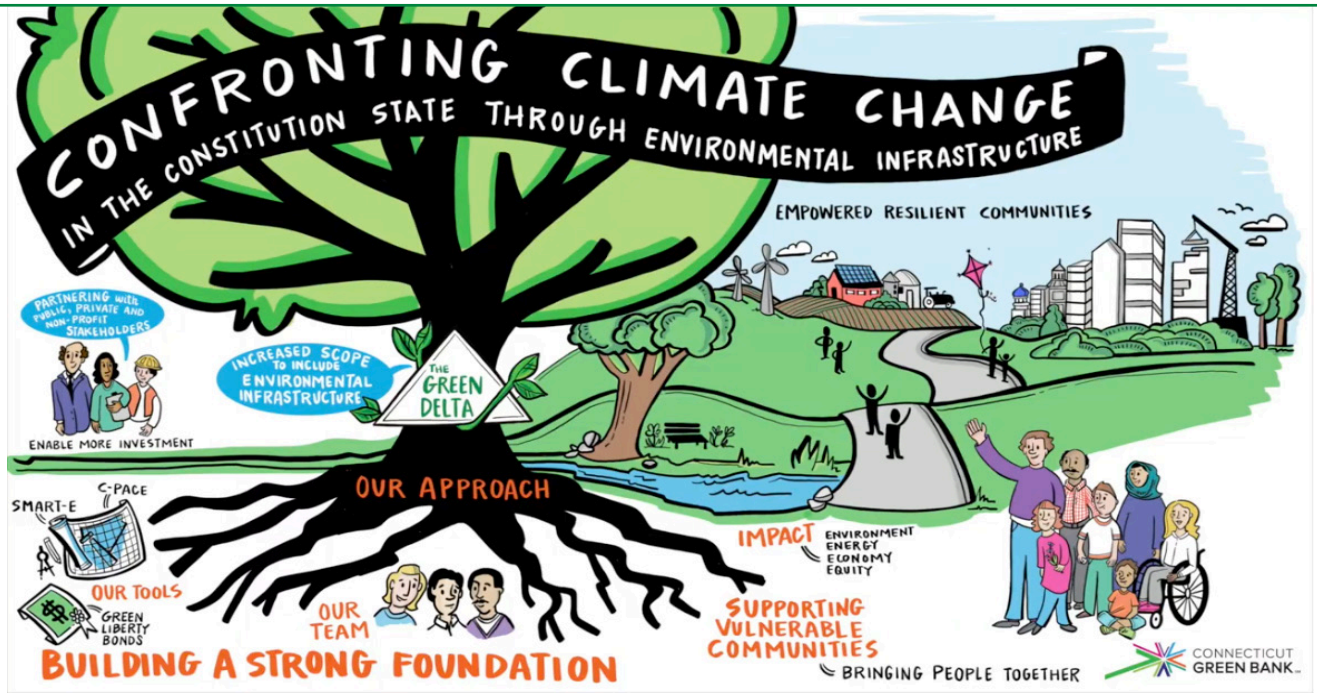


**Waste and Recycling**



**Water**

# letter from our Chair




*To watch the animated version of this graphic please visit, https://www.youtube.com/watch?v=6V3wwMcaUvU*

**Lonnie Reed**
*Green Bank Chair*

As Connecticut's efforts to confront climate change grow, the Connecticut Green Bank is assigned more tasks and must cultivate new ways to help achieve the Future we all seek - that zero carbon world where the environment is cleaner, the people healthier, the opportunities more abundant and the economy more robust. That world - that goal is our Green Delta.

The Green Bank's 10 years of remarkable growth are rooted in a deep commitment to equity, accessibility, and positive real world change. The Green Bank meets challenges by sowing seeds of innovation - creating assets such as Green Liberty Bonds and Community Matching Funds, then harvesting their successful yields to support more renewable growth.

The Governor, the Legislature and key energy and environmental allies have extended Green Bank responsibilities. They now include putting Environmental Infrastructure to work combating climate change. This involves systems and services related to water, waste and recycling, climate adaptation and resiliency. Also agriculture, parks and recreation and environmental markets such as carbon offsets and ecosystem services.

Bringing the Green Bank into infrastructure development should help the state achieve multiple goals - from federal Justice40 investments to workforce development in underserved communities. Success will require us to turn community engagement into community empowerment by inviting new voices into our decision making process.

In April 2022, the Green Bank invited expert stake holders to join Green Bank Board members and senior staff for a strategic conference to analyze where we all are, where we are going and how we can get there faster and more affordably by working together.

The Green Bank is uniquely positioned to know who the effective stake holders are and how to encourage their partnering. Participants say they feel confident and comfortable working with the Green Bank team.

The key conference take away — with hard work, dedication, cooperation and focus our ambitious objectives are achievable. Green Delta — Here we come!

# officers & board

## Officers

**Bryan Garcia,** President & CEO

**Mackey Dykes,** Vice President of Financing Programs

**Brian Farnen,** General Counsel and Chief Legal Counsel

**Bert Hunter,** Executive Vice President & Chief Investment Officer

## Board of Directors*

**Lonnie Reed, Board Chair,** Documentary Filmmaker & Former State Representative

**Binu Chandy,** Deputy Director at DECD, as Ex Officio

**Vicki Hackett, Board Vice Chair,** Deputy Commissioner at CT DEEP, as Ex Officio

**Matthew Ranelli, Board Secretary,** Partner, Shipman & Goodwin, LLP

**Sarah Sanders,** Office of the Treasurer, as Ex Officio

**Matthew Dayton,** Office of Policy Management, as Ex Officio

**Adrienne Farrar Houël,** Founder, President & CEO of Greater Bridgeport Community Enterprises, Inc.

**Dominic Grant,** Director of Investment, Dirt Capital Partners

**John Harrity,** Former President, Connecticut State Council of Machinists

**Laura Hoydick,** Mayor of Stratford

**Thomas M. Flynn,** Senior Director, Private Equity Services Operation Group, Alvarez & Marsal

**Brenda Watson,** Executive Director, Operation Fuel

**As of 06-30-2022*

# letter from the Governor

Throughout my administration, it has been a priority to protect Connecticut's progress in addressing climate change by supporting the deployment of more renewable energy and ensuring greater investment in vulnerable communities. In 2022, a number of Public Acts have helped solidify these goals and enhanced our ability to further reduce energy cost burdens and create jobs.

**Connecticut Governor Ned Lamont**

In May, I proudly signed into law three bills that further demonstrate our commitment to decarbonizing our electric sector, expanding existing renewable energy programs, and enabling more zero-emission transportation. We are continuing to set an example for what a state can do to become more environmentally sustainable and make meaningful progress to reduce greenhouse gas emissions. The first, Public Act 22-5 An Act Concerning Climate Change Mitigation, codified our 2040 zero-carbon electric grid goal and took effect July 1.

The second, Public Act 22-14 An Act Concerning Clean Energy Tariff Programs, allowed for the expansion of existing programs supporting on-site renewable energy generation. This will open greater and more equitable participation in the green economy, and will help to reduce the energy burden for participating customers, particularly those in vulnerable communities.

And the third, in July, Public Act 22-25 An Act Concerning the Connecticut Clean Air Act was enacted. This enables the reduction of greenhouse gas (GHG) emissions from the transportation section, which is a large source of harmful pollutants. The benefits to the residents of Connecticut are clear: improved air quality and health outcomes. It also provided greater access to the state's CHEAPR program, giving priority to low-income individuals and residents of environmental justice communities, and set a target of 100% zero-emission school buses in environmental justice communities by 2030 and for all school districts by 2040. With the help of the Green Bank, and some funds from the Regional Greenhouse Gas Initiative, we expect to see more zero-emission school buses on the road, especially in environmental justice communities.

Finally, in August, I applauded President Biden's leadership and that of our Congressional delegation for their passage of the Inflation Reduction Act. Connecticut is again serving as a national leader, as our Green Bank's success offered a template for this historic legislation's inclusion of the Greenhouse Gas Reduction Fund, and now serves as an example for the rest of the country.

With so much positive legislation at home and nationally, and leaders like the Connecticut Green Bank, we are positioned to continue to grow our green economy and make more progress towards our goals in 2023 and beyond.

# new Hartford headquarters features heroic meeting rooms

In the summer of 2021, the Green Bank moved into its new Hartford headquarters in the Non-Profit Center at 75 Charter Oak Avenue, out of a desire to be closer to the community we serve. The building itself is a former brownfield that once held the Atlantic Screw Works, where screw-making machines were built in the late 1800s. As we branded the space to match our story, we honored Connecticut's rich history of innovation and climate activism along with our heroes in our meeting spaces.

*The Pope Conference Room*

*The Baker Conference Room*

*The Freeman Conference Room*

*The Gina McCarthy Meeting Space*

One meeting room is named after Albert Pope, a Civil War hero, manufacturer, distributor, and entrepreneur, who lived in Hartford (1843-1909). Pope was initially focused on making America's first bicycles (Columbia Bicycle Company), but then turned his attention to making the first electric vehicles. Using assembly line mass production techniques, Pope employed thousands of people in what was the center of the automobile industry in the late 1800s. In 1902, President Theodore Roosevelt, a Republican and environmental conservationist, rode in a Columbia Electric Victoria Phaeton, made by Pope, in the first Presidential motorcade in an electric vehicle.

Another hero is Dr. Bernard S. Baker, a pioneer in the fuel cell industry. He was a Connecticut resident and was a founder and served as president, chief executive officer and chairman of Energy Research Corporation (now called FuelCell Energy, Inc., in Danbury, developer and manufacturer of direct fuel cells used to generate electric power. Connecticut continues to be a leader in fuel cells, thanks in part to Baker's work.

The third meeting room is named after Mary & Eliza Freeman, whose historic Bridgeport homes are the last ones surviving from the "Little Liberia" settlement of free African Americans started in 1831. Now part of the Freeman Center, the preserved homes sit in the shadow of a coal-fired power plant and serve as a reminder of the need for environmental justice. The room has two striking walls: one features Maya Angelou's poem *On the Pulse of Morning*, and the other has an image of solar homes based on Prince Street in Bridgeport, where Melvin, who went solar in 2015, convinced three neighbors to follow suit after seeing his savings.

Other smaller meeting spaces are named for Gina McCarthy, former Green Bank Board member, administrator of the Environmental Protection Agency, and the first White House National Climate Advisor, and Greta Thunberg, the environmental activist from Sweden.

## STATEMENTS OF NET POSITION

| | 2022 | 2021 | Increase (Decrease) |
|---|---|---|---|
| Cash and cash equivalents - unrestricted | $ 52,277 | $ 42,861 | $ 9,416 |
| Other current assets | 37,164 | 36,063 | 1,101 |
| Program loans & other long term assets | 97,244 | 97,773 | (529) |
| Capital assets, net | 76,165 | 79,694 | (3,529) |
| Cash and cash equivalents - restricted | 21,645 | 21,900 | (255) |
| **Total assets** | **$ 284,495** | **$ 278,291** | **$ 6,204** |
| | | | |
| Deferred amount for pensions | $ 6,439 | $ 4,551 | $ 1,888 |
| Deferred amount for OPEB | 5,173 | 5,238 | (65) |
| Deferred amount for asset retirement obligations | 2,317 | 2,488 | (171) |
| **Total deferred outflows of resources** | **$ 13,929** | **$ 12,277** | **$ 1,652** |
| | | | |
| Current liabilities | $ 29,906 | $ 19,176 | $ 10,730 |
| Long term liabilities | 83,415 | 106,569 | (23,154) |
| Fair value of interest rate swap | -- | 699 | (699) |
| Pension liability | 21,273 | 20,269 | 1,004 |
| OPEB liability | 20,517 | 23,689 | (3,172) |
| **Total liabilities** | **$ 155,111** | **$ 170,402** | **$ (15,291)** |
| | | | |
| Deferred amount for pensions | $ 5,425 | $ 5,072 | $ 353 |
| Deferred amount for OPEB | 9,694 | 7,227 | $ 2,467 |
| Deferred amount for leases | 17,056 | 18,372 | $ (1,316) |
| **Total deferred inflows of resources** | **$ 32,175** | **$ 30,671** | **$ 1,504** |
| | | | |
| **Net position, unadjusted** | | | |
| Invested in capital assets | $ 5,516 | $ 5,327 | $ 189 |
| Restricted Net Position: | | | |
| Non-expendable | 57,730 | 62,674 | (4,944) |
| Restricted - energy programs | 16,865 | 16,881 | (16) |
| Unrestricted Net Position | 31,027 | 4,613 | 26,414 |
| **Total net position, unadjusted** | **$ 111,138** | **$ 89,495** | **$ 21,643** |
| | | | |
| **Net position, adjusted** | | | |
| Unrestricted Net Position | $ 31,027 | $ 4,613 | $ 26,414 |
| Contingent liabilities - programs and projects[1] | (81,531) | (66,575) | (14,956) |
| **Total net position, adjusted** | **$ (50,504)** | **$ (61,962)** | **$ 11,458** |

[1] *See Note III (B.) to Connecticut Green Bank's 2022 audited financial statements for further detail.*

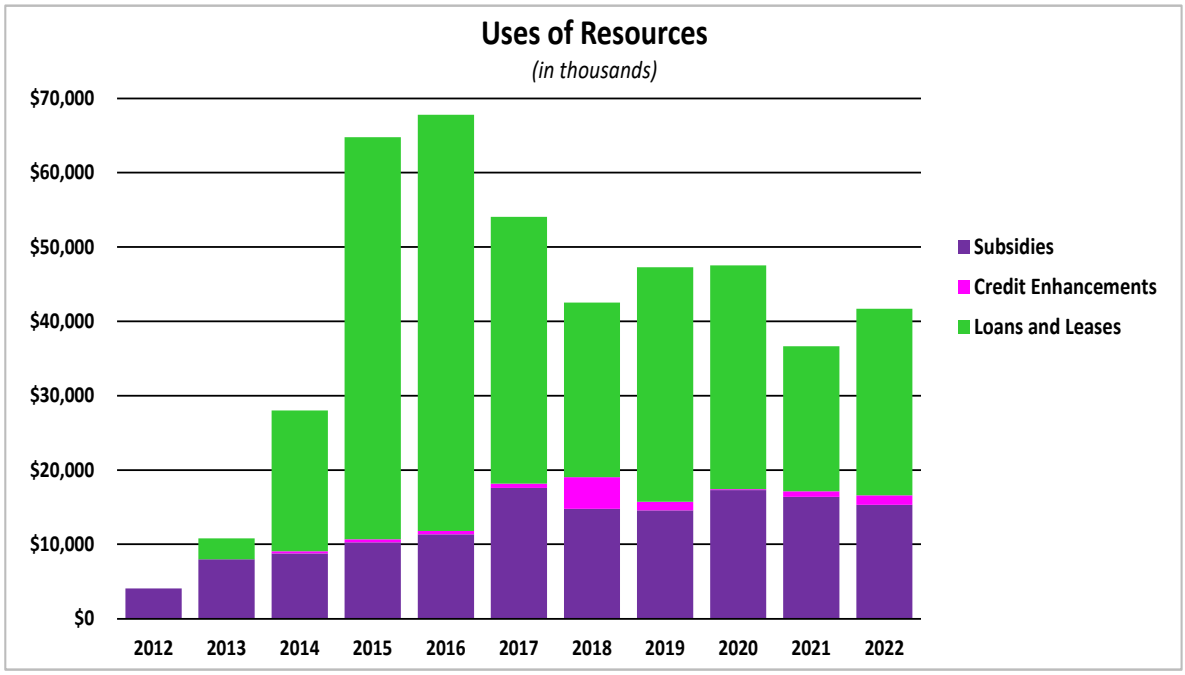
For the years ended June 30, 2022 and 2021:

*(in thousands)*

## STATEMENTS OF REVENUE, EXPENSE AND CHANGE IN NET POSITION

| | 2022 | 2021 | Increase (Decrease) |
|---|---|---|---|
| **Revenues** | **$ 60,715** | **$ 55,921** | **$ 4,794** |
| **Operating Expenses:** | | | |
| Grants and incentive programs | $ 15,997 | $ 15,880 | $ 117 |
| Program administration expenses | 19,718 | 17,569 | 2,149 |
| Cost of goods sold - energy systems | 451 | 747 | (296) |
| General and administrative expense | 3,214 | 3,953 | (739) |
| Provision for loan losses | (3,561) | 239 | (3,800) |
| **Total Operating Expenses** | **$ 35,819** | **$ 38,388** | **$ (2,569)** |
| **Operating Income** | **$ 24,896** | **$ 17,533** | **$ 7,363** |
| Non-operating revenue (expense) | (2,652) | (4,253) | 1,601 |
| Distributions | (601) | (527) | (74) |
| **Total Non-Operating Revenue (Expenses)** | **$ (3,253)** | **$ (4,780)** | **$ 1,527** |
| **Net Change** | **$ 21,643** | **$ 12,753** | **$ 8,890** |

*For more details on the financial statements, please access the Annual Comprehensive Financial Report (June 30, 2022) at www.ctgreenbank.com*



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**ctgreenbank.com**

CONNECTICUT
GREEN BANK

# Memo

**To:** Connecticut Green Bank Board of Directors

**From:** Jane Murphy, EVP Finance and Administration

**Date:** January 13, 2023

**Re:** Review of proposed revisions to Accounting Internal Control Procedures

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It is a best practice to review the Connecticut Green Bank's ("CGB") internal accounting control procedures for updates necessary to reflect changes in organizational procedures and programs. The Internal Controls document, which includes the five procedures listed below, is included for review and discussion at our meeting. Clean and redline versions have been provided to highlight the recommended changes.

**Accounting Department Internal Controls and Procedures**
CGB 101 – Purchasing and Accounts Payable
CGB 102 – Consulting and Advisory Services
CGB 103 – Credit Cards
CGB 104 – Mobile Devices
CGB 105 – Fixed Assets and Depreciation

All internal control procedures are being updated to replace specific position titles with generic position titles so the procedures remain up to date if staff titles change. Additionally, the Purchasing and Accounts Payable procedures are being updated to:

- Reflect handling of invoice approvals while staff is out of the office,
- Include an accounting department designee for electronic payment processing should the need arise,
- Remove the requirement that the President & CEO approve intercompany cash transfers, and
- Remove the requirement that upon return to the office, the President & CEO reapprove all invoices approved by a designee.

Staff is requesting that the following resolution be approved by the Board of Directors, which will be reviewed by the Audit, Compliance and Governance Committee this week prior to the Board meeting:

**RESOLUTION:**

**WHEREAS**, all Accounting internal control procedures of the Green Bank are being updated to revise the written delegation of authority process and replace specific position titles with generic position titles, with the goal of having the procedures remain up to date if staff titles change

**NOW,** therefore be it:

**RESOLVED**, that the Board of Directors hereby approve the proposed revisions to the Internal Accounting Controls and Procedures as presented herein.

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**ctgreenbank.com**

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Connecticut Green Bank and Component Units

Accounting Department
Internal Controls and Procedures
Index

# Purchasing and Accounts Payable Policies and Procedures

## I. Purpose:

To provide procedures for procurement methods and completion of related documents.

## II. Scope:

This procedure applies to the purchase of supplies, materials, services, sponsorships, memberships, software and capital assets for all departments within the Connecticut Green Bank (CGB) as well as for all component units for which CGB provides accounting and financial reporting services, whether operating or programmatic in nature.

## III. Responsibility:

Procurement of supplies will be facilitated through the operations and accounting departments. Procurement of services will be initiated by the person requiring the services. Subscriptions will be initiated and monitored by the marketing and outreach department. All named parties are responsible for using good purchasing methods for optimizing price savings, quality and value of products, vendor working relationships, and for assuring proper control and inspection as required by these policies. All named parties will utilize purchase orders or such other purchasing documents that are developed and revised from time to time as necessary by the operations and accounting departments.

## IV. Procedure:

A. ORDER PLACEMENT AND APPROVALS

1. Office supplies - and other goods and services used in the normal course of business are approved by the Head of Finance & Administration or the Head of Operations.
2. Office furniture, fixtures and equipment - must be approved by the President & CEO or the Head of Operations.
3. Subscriptions and Reference Materials – Subscriptions to magazines, newspapers, on-line reference and search services, etc. must be approved by the Head of Marketing or the Head of Operations.
4. Computer Equipment and Software - All purchases of computer equipment, software and related items must be in writing. All purchases under $1,000 will be approved by the Office Manager. All purchases $1,000 or greater will follow the approval process outlined in B1 below.
5. Travel and Entertainment – All business travel and entertainment must be approved by the employee's immediate supervisor. All requests for reimbursement of T&E expenses greater than $1,000 must follow the approval guidelines set forth in Section B below. All international travel must

be pre- approved by the President & CEO. All international travel by the President & CEO must be pre-approved by the Chairperson of the CGB Board. See the Company Travel and Entertainment Policy for guidelines on business expenditures that will be reimbursed.

6. Financial Assistance – The process of approving financial assistance consisting of grants, loans, loan guarantees, debt and equity investments or other financial products is outlined in the bylaws and operating procedures of the CGB.
7. Sponsorships and Memberships – All CGB sponsorships and memberships must be approved by Director level staff and the Head of Operations.
8. Consulting and Advisory Services – See CGB – 102 for procedures related to internal management of consulting and advisory services.
9. Legal Fees – Due to the nature of legal fees, approval for fees is obtained when the invoice is received. All invoices will be forwarded to the General Counsel & Chief Legal Officer and the President & CEO for their approvals before payment is made.

B. PROCESSING OF VENDOR INVOICES FOR GOODS AND SERVICES

1. Approval of Invoices – must be obtained prior to sending to Accounts Payable for payment processing.
   a. Goods and Services
      - Invoice < $1000 – requires signature of project/department manager level or higher.
      - Invoice equal to or greater than $1,000 –requires the signature of one of the following: Head of Finance & Administration; Head of Operations; General Counsel & Chief Legal Officer; President & CEO; Chief Investment Officer; collectively named “Management”.
      - Invoice equal to or greater than $5,000 – requires 2 signatures from Management.
      - Invoice equal to or greater than $25,000 – requires 2 signatures from. Management, one of which must be the President & CEO.
      - Non-budgeted items – requires approval of Head of Operations as well as approval according to $ limit approval procedures noted above.
   b. Financial Assistance (as defined in A6 above)
      - Up to $25,000 – requires 2 signatures from Management, one of which must be the President & CEO or the Head of Operations or, in both their absence, the Head of Finance & Administration.
      - Equal to or above $25,000 – requires 2 signatures from Management, one of which must be the President & CEO or in his/her absence the Head of Finance & Administration.
   c. Consulting and Advisory Services – See CGB – 102
   d. Re-occurring charges – for disbursements that occur on a regular basis (rents, equipment lease payments, etc. the Head of Finance & Administration must approve the invoice. A second signature from a member of Management is not required.

e. Transfers of funds between CGB and its component units for working capital purposes – transfers of funds between CGB and its component units for working capital purposes will only require the approval of the Head of Finance & Administration at time of transfer.

2. Approval in the absence of the President & CEO – If the President & CEO is unavailable for a period of time to approve invoices or purchases enumerated in section A above, he/she may delegate his/her authority to approve such purchases and invoices to the Head of Finance and Administration or in the absence of the Head of Finance and Administration, the Head of Operations, Chief Investment Officer or General Counsel & Chief Legal Officer in writing.

3. Approval in the absence of the Head of Finance and Administration – If the Head of Finance and Administration is unavailable for a period of time, the President & CEO may designate in writing a senior member of the Accounting Department (Controller or Associate Director) to approve invoices or purchases enumerated in section A above. Additionally, this designee may perform tasks of the Head of Finance and Administration as it relates to electronic payments as noted in Section 6 below. There will be no impact on check signing.

4. Payment of invoices
   a. Accounts Payable will process invoices for payment when all approvals are obtained by requestor.
   b. Payment of invoices will be made based on vendor terms.
   c. Check signing:
      - Invoice and all related documents are submitted to Accounts Payable.
      - Check amounts equal to or greater than $5,000 require 2 signatures
      - The Board of Directors will authorize specific senior level positions to sign checks on behalf of the Company. This authorization will be documented in the Board meeting minutes.

5. Check requests
   A check request or a SharePoint approval email may be used as approval documentation for invoices.

6. Wire/ACH transfers
   a. The processing of wire/ACH disbursements requires two authorized individuals to execute the transaction: one to initiate/approve and one to release the transaction. The initiate/approve function may be processed by the Head of Finance & Administration or his/her Accounting Department Designee. If the Accounting Department Designee performs the initiate/approve function, the Head of Finance & Administration may perform the release function. If the Head of Finance & Administration performs the initiate/approve function, another authorized check signer must perform the release function.

b. Financial Assistance – No wire/ACH will be initiated until the Head of Finance & Administration or his/her designee has reviewed all appropriate executed legal documents to verify that the disbursement is being made in accordance with the requirements of such documents.

# Consulting and Advisory Services

**I. Purpose:**
Pursuant to operating procedures initially adopted by the Board of Directors of the Connecticut Green Bank (CGB) on December 16, 2011 as amended from time to time; CGB may contract for consulting and advisory services as part of its operations and programs.

**II. Scope**:
These services may include expertise or specialized advice, training, research or analysis, special projects or other work where the (a) appropriate experience, skills or expertise is not then available among the staff because of workload or other constraints, (b) the time duration, frequency of need or other nature of the services does not justify employing staff to provide such services, or (c) Board of Directors has determined that the use of such services is warranted and in the best interest of CGB. These procedures also apply to all component units of CGB for which CGB provides accounting and financial reporting services. CGB and its component units are collectively referred to as the "Company" in these procedures.

**III. Responsibility:** All staff contracting for consulting and advisory services must follow this procedure.

**IV. Procedure:**

A. Request for Services - All such services will be requested through the use of the Company's standard Approval Release Slip (ARS). The ARS will be attached to a draft Professional Service Agreement (PSA) developed and revised from time to time as necessary by the Company's legal department. Upon the approval of the ARS by staff as outlined below in section B, a PSA will be executed between the Company and the provider of the services requested.

B. Approval of ARS and execution of PSA:

1. Approval of ARS: All ARS forms require the following sign offs before the Company's legal department will process the related PSA: 1) the manager who has budget responsibility for the program seeking the services, 2) the Head of Finance & Administration, 3) the Head of Operations and 4) the General Counsel & Chief Lega Officer.

2. Execution of the PSA: The President & CEO will execute all PSA's on behalf of the company. However, see 5 below.

3. ARS requests greater than $75,000 to $150,000 must be approved in writing by the President and CEO and Chairperson of the Board prior to execution of PSA under B1 above.

4. ARS requests greater than $150,000 must follow the RFP requirements in section C prior to execution of PSA under B1 above.

5. Execution of PSA's and approval of ARS requests the absence of the President & CEO – If the President & CEO is unavailable for a period of time to execute PSAs or approve ARS's as required, he/she may delegate his/her authority to approve purchases to the Head of Finance & Administration or in the absence of the Head of Finance & Administration the Head of Operations, Chief Investment Officer or General Counsel & Chief Legal Officer in writing. The Head of Finance & Administration must then forward all items approved under this section to the President & CEO upon his/her return to the office and obtain approval from the President and CEO at that time.

6. All ARS requests will be reviewed by the Head of Operations and Head of Finance & Administration to ensure that the requested disbursement falls within the appropriate departmental budget for the current fiscal year prior to approval**.**

C. PSA duration and RFP requirements

1. Duration - The duration of PSAs for consulting or advisory services will generally not exceed one year without written approval of the President & CEO.

2. Whenever possible, an RFP is to be completed prior to entering into any contract in an amount over $150,000 in any one fiscal year.

3. Contractors with multiple contracts - CGB may engage the same contractor for several different projects or for continuations of a single project during a fiscal year. A PSA which will, if executed, result in cumulative expenditures to the contractor exceeding $150,000 in any one fiscal year will require, whenever possible, that an RFP be completed prior to the execution of the PSA.

D. Recordkeeping

1. The department of finance and administration will prepare and maintain a summary of all outstanding contracts. The summary will include the name of the contractor, a brief description of the services/project, the total amount of the contract and actual amount paid to date.

2. The Head of Finance & Administration will be responsible for monitoring the status of approved contracts and ensuring that all contracts are in compliance with these operating procedures.

# Credit Card Policy and Procedures

## I. Purpose:

To provide procedures for the use of Connecticut Green Bank, ("CGB") owned credit cards by authorized employees of the CGB.

## II. Policy/Scope:

CGB owned credit cards will be issued to those employees who are designated as purchasing agents for CGB by the President and CEO. CGB owned credit cards will be used for official CGB business to purchase goods and services on behalf of CGB or to make travel arrangements on behalf of CGB employees who are traveling on CGB business. CGB owned credit cards shall not be used for personal or private business. Intentional misuse or fraudulent abuse of any CGB owned credit card may result in disciplinary action, up to and including dismissal. In addition, the authorized holder of the CGB owned credit card shall promptly reimburse CGB for any unacceptable or unauthorized purchases.

## III. Responsibility:

The Head of Finance & Administration shall be responsible for the administration of the CGB credit card account.

## IV. Procedures:

1. The President and CEO ("CEO") and the Head of Operations are authorized purchasing agents of the CGB. The CEO shall provide the Head of Finance & Administration with a list of additional employees who are authorized purchasing agents for CGB. This list will be updated from time to time by the CEO as circumstances warrant. A credit card dollar limit will be approved by the CEO for each authorized purchasing agent.

2. The Head of Finance & Administration as administrator of the CGB credit card account will approve and submit an application to the credit card issuer requesting that a card be issued (with the authorized dollar limit) to the CGB purchasing agent.

3. Once the CGB credit card is issued to the authorized purchasing agent, the purchasing agent will be responsible for maintaining adequate documentation supporting all purchases made with the credit card. This documentation shall be attached to the monthly credit card invoice and submitted to the Head of Finance & Administration for review and approval. The Head of Finance & Administration will review the documentation submitted to determine that the expenditure was for an appropriate business purpose. The credit

card invoice will be approved by the Head of Finance & Administration and the Chief Legal Counsel.

4. It is the purchasing agent's responsibility to monitor his or her account for unauthorized activity. All unauthorized activity should immediately be reported to the credit card issuer and Head of Finance & Administration for appropriate action.

5. Purchasing agents who have been issued a CGB owned card will be responsible for safeguarding the card at all times. The purchasing agent is responsible for immediately and properly reporting a lost or stolen card to the credit card issuer and the Head of Finance & Administration.

6. A copy of this policy will be provided to each purchasing agent. The purchasing agent will be required to acknowledge receipt of the policy.

CGB – 104
Revised
January 17, 2023

# Mobile Device Policy and Reimbursement Procedure

## Policy

The Connecticut Green Bank ("CGB") often must have immediate access to key employees. Accordingly, CGB will provide mobile devices with cell and internet access to an employee if the employee's responsibilities require the employee to be out of the office on Company business and the employee needs to be in contact with CGB staff or its partners during that time.

## Procedure

Mobile device plans bundle "voice" minutes and "data" minutes for a monthly fee.

Employees can be reimbursed for the associated monthly voice and data charges by submitting an approved employee expense report with appropriate backup including dates of service to the accounting department on a monthly basis up to the limit established by the organization. If an employee's cell phone service is part of a "family" plan, the employee will only be reimbursed for the charges allocated to their cell phone number. Dollar limits will be reviewed and adjusted periodically by the President and CEO and the Head of Operations. Pre-Approval forms may be obtained from the accounting department. All requests for mobile communications devices and associated voice/data plans must be approved by the Head of Operations. ***Charges incurred that were not pre-approved or above the pre-approved limit will be the responsibility of the employee.***

Costs outside of this procedure will be reviewed on a case by case basis and should seek pre-approval whenever possible.

CGB -105
Revised January 17,2023

# Fixed Assets and Depreciation

**I. Purpose:** To set policy and controls over the recording of fixed assets related depreciation.

**II. Scope**: This policy applies to all purchases of furniture, equipment, software and leasehold improvements.

**III. Responsibility:** The Head of Finance & Administration and Controller are responsible for monitoring and tracking fixed assets and related depreciation.

**IV. Procedure:**

a. All computer hardware and software, office furniture and equipment, and leasehold improvement items purchased with a value greater than $1,000 are capitalized and recorded as fixed assets.

b. The Staff Accountant or Senior Accountant records the fixed asset vendor invoice to the appropriate fixed asset account. Invoices are approved using internal accounting control procedure CGB 101 – Purchasing and Accounts Payable.

c. The Senior Accountant, Controller, or Head of Finance & Administration reviews fixed asset purchases on a monthly basis and inputs the appropriate financial information in the Intacct business system using the following categories and useful lives:

    i. Furniture and Equipment – 5 years
    ii. Computer Hardware – 3 years
    iii. Computer Software – 3 or 2 years
    iv. Leasehold Improvements – 5 years or life of lease, whichever is less

d. Depreciation is calculated by Intacct using the straight-line method on a yearly basis and reconciled monthly.

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CONNECTICUT GREEN BANK

Connecticut Green Bank and Component Units

Accounting Department
Internal Controls and Procedures
Index

# Purchasing and Accounts Payable Policies and Procedures

## I. Purpose:

To provide procedures for procurement methods and completion of related documents.

## II. Scope:

This procedure applies to the purchase of supplies, materials, services, sponsorships, memberships, software and capital assets for all departments within the Connecticut Green Bank (CGB) as well as for all component units for which CGB provides accounting and financial reporting services, whether operating or programmatic in nature.

## III. Responsibility:

Procurement of supplies will be facilitated through the operations and accounting departments. Procurement of services will be initiated by the person requiring the services. Subscriptions will be initiated and monitored by the marketing and outreach department. All named parties are responsible for using good purchasing methods for optimizing price savings, quality and value of products, vendor working relationships, and for assuring proper control and inspection as required by these policies. All named parties will utilize purchase orders or such other purchasing documents that are developed and revised from time to time as necessary by the operations and accounting departments.

## IV. Procedure:

A. ORDER PLACEMENT AND APPROVALS

1. Office supplies - and other goods and services used in the normal course of business are approved by the ~~VP of Finance ("VPF")~~ Head of Finance & Administration or the ~~Director of Operations ("DOO")~~Head of Operations.
2. Office furniture, fixtures and equipment - must be approved by the President & CEO or the ~~DOO~~Head of Operations.
3. Subscriptions and Reference Materials – Subscriptions to magazines, newspapers, on-line reference and search services, etc. must be approved by the ~~Managing Director~~Head of Marketing ~~(MDM)~~ or the ~~DOO~~Head of Operations.
4. Computer Equipment and Software - All purchases of computer equipment, software and related items must be in writing. All purchases under $1,000 will be approved by the Office Manager. All purchases $1,000 or greater will follow the approval process outlined in B1 below.
5. Travel and Entertainment – All business travel and entertainment must be approved by the employee's immediate supervisor. All requests for reimbursement of T&E expenses greater than $1,000 must follow the

approval guidelines set forth in Section B below. All international travel must be pre- approved by the President & CEO. All international travel by the President & CEO must be pre-approved by the Chairperson of the CGB Board. See the Company Travel and Entertainment Policy for guidelines on business expenditures that will be reimbursed.

6. Financial Assistance – The process of approving financial assistance consisting of grants, loans, loan guarantees, debt and equity investments or other financial products is outlined in the bylaws and operating procedures of the CGB.
7. Sponsorships and Memberships – All CGB sponsorships and memberships must be approved by Director level staff and the ~~DOO~~Head of Operations.
8. Consulting and Advisory Services – See CGB – 102 for procedures related to internal management of consulting and advisory services.
9. Legal Fees – Due to the nature of legal fees, approval for fees is obtained when the invoice is received. All invoices will be forwarded to the General Counsel & Chief Legal ~~Counsel~~ Officer and ~~DOO~~the President & CEO for their approvals before payment is made.

B. PROCESSING OF VENDOR INVOICES FOR GOODS AND SERVICES

1. Approval of Invoices – must be obtained prior to sending to Accounts Payable for payment processing.
   a. Goods and Services
      - Invoice < $1000 – requires signature of project/department manager level or higher.
      - Invoice equal to or greater than $1,000 –requires the signature of one of the following: ~~VPF~~Head of Finance & Administration; ~~DOO~~Head of Operations; General Counsel & Chief Legal Officer; President & CEO; ~~EVP and~~ Chief Investment Officer; collectively named “Management”.
      - Invoice equal to or greater than $5,000 – requires 2 signatures from Management.
      - Invoice equal to or greater than $25,000 – requires 2 signatures from. Management, one of which must be the President ~~and~~ & CEO.
      - Non-budgeted items – requires ~~signature~~ approval of ~~DOO~~Head of Operations as well as approval according to $ limit approval procedures noted above.
      -

   b. Financ~~ial~~e Assistance (as defined in A6 above)
      - U~~u~~p to $25,000 – requires 2 signatures from Management, one of which must be the President & CEO or the ~~DOO~~Head of Operations or, in both their absence, the ~~VPF~~Head of Finance & Administration.
      - ~~Finance Assistance (as defined in A6 above) e~~Equal to or above $25,000 – requires 2 signatures from Management, one of which must be the President & CEO or in his/~~ or~~ her absence the ~~VPF~~Head of Finance & Administration.
      -

   c. Consulting and Advisory Services – See CGB – 102

- d. Re-occurring charges – for disbursements that occur on a regular basis (rents, equipment lease payments, etc. the VPFHead of Finance & Administration must approve the invoice. A second signature from a member of Management is not required.
- e. Transfers of funds between CGB and its component units for working capital purposes – transfers of funds between CGB and its component units for working capital purposes will only require the approval of the VPFHead of Finance & Administration at time of transfer. Documentation of the transfer will be forwarded to the President and CEO for review and sign off within 2 business days after transfer. All transfers will be executed by wire transfer which require approval and release by 2 authorized check signers.

2. Approval in the absence of the President & CEO – If the President & CEO is unavailable for a period of time to approve invoices or purchases enumerated in section A above, he/she may delegate his/her authority to approve such purchases and invoices to the VPFHead of Finance and Administration or in the absence of the VPFHead of Finance and Administration, the DOOHead of Operations, Chief Investment Officer or General Counsel & Chief Legal Officer in writing. The VPF or such other designee listed above must then submit all such items to the President & CEO upon his/her return to the office and obtain approval from the President & CEO at that time.

3. Approval in the absence of the Head of Finance and Administration – If the Head of Finance and Administration is unavailable for a period of time, the President & CEO may designate in writing a senior member of the Accounting Department (Controller or Associate Director) to approve invoices or purchases enumerated in section A above. Additionally, this designee may perform tasks of the Head of Finance and Administration as it relates to electronic payments as noted in Section 6 below. There will be no impact on check signing.

2.

3.4. Payment of invoices –

a. Accounts Payable will process invoices for payment when all approvals are obtained by requestor.
b. Payment of invoices will be made based on vendor terms.
c. Check signing:
   - Invoice and all related documents are submitted to Accounts Payable.
   - Check amounts equal to or greater than $5,000 require 2 signatures
   - The Board of Directors will authorize specific senior level positions to sign checks on behalf of the Company. This authorization will be documented in the Board meeting minutes.

~~4.~~5. Check requests

~~a.~~ A check request or a SharePoint approval email may be used as approval documentation for invoices. ~~Invoices may be signed directly as well. The finance and administration department will develop and maintain check request forms.~~

~~5.~~6. Wire/ACH transfers

a. The processing of wire/ACH disbursements ~~will follow the same process for checks as documented in section 3c. above with the exception that all wires or ACH transactions require that 2 authorized check signors are required to execute the transaction: one to initiate and approve and one to release the transaction.~~requires two authorized individuals to execute the transaction: one to initiate/approve and one to release the transaction. The initiate/approve function may be processed by the Head of Finance & Administration or his/her Accounting Department Designee. If the Accounting Department Designee performs the initiate/approve function, the Head of Finance & Administration may perform the release function. If the Head of Finance & Administration performs the initiate/approve function, another authorized check signer must perform the release function.

b. Financial Assistance – No wire/ACH will be initiated until the ~~VPF~~Head of Finance & Administration or his/her designee has reviewed all appropriate executed legal documents to verify that the disbursement is being made in accordance with the requirements of such documents.

CGB – 102
Revised ~~July 27, 2018~~January 17, 2023

# Consulting and Advisory Services

**I. Purpose:**
Pursuant to operating procedures initially adopted by the Board of Directors of the Connecticut Green Bank (CGB) on December 16, 2011 as amended from time to time; CGB may contract for consulting and advisory services as part of its operations and programs.

**II. Scope**:
These services may include expertise or specialized advice, training, research or analysis, special projects or other work where the (a) appropriate experience, skills or expertise is not then available among the staff because of workload or other constraints, (b) the time duration, frequency of need or other nature of the services does not justify employing staff to provide such services, or (c) Board of Directors has determined that the use of such services is warranted and in the best interest of CGB. These procedures also apply to all component units of CGB for which CGB provides accounting and financial reporting services. CGB and its component units are collectively referred to as the "Company" in these procedures.

**III. Responsibility:** All staff contracting for consulting and advisory services must follow this procedure.

**IV. Procedure:**

A. Request for Services - All such services will be requested through the use of the Company's standard Approval Release Slip (ARS). The ARS will be attached to a draft Professional Service Agreement (PSA) developed and revised from time to time as necessary by the Company's legal department. Upon the approval of the ARS by staff as outlined below in section B, a PSA will be executed between the Company and the provider of the services requested.

B. Approval of ARS and execution of PSA:

1. Approval of ARS: All ARS forms require the following sign offs before the Company's legal department will process the related PSA: 1) the manager who has budget responsibility for the program seeking the services, 2) the ~~VPF~~ Head of Finance & Administration, 3) the ~~DOO~~ Head of Operations and 4) the General Counsel & Chief Lega~~l~~ Officer.

2. Execution of the PSA: The President & CEO will execute all PSA's on behalf of the company. However, see 5 below.

3. ARS requests greater than $75,000 to $150,000 must be approved in writing by the President and CEO and Chairperson of the Board prior to execution of PSA under B1 above.

4. ARS requests greater than $150,000 must follow the RFP requirements in section C prior to execution of PSA under B1 above.

5. Execution of PSA's and approval of ARS requests the absence of the President & CEO – If the President & CEO is unavailable for a period of time to execute PSAs or approve ARS's as required, he/she may delegate his/her authority to approve purchases to the ~~VPF~~ Head of Finance & Administration or in the absence of the ~~VPF~~ Head of Finance & Administration the ~~DOO~~ Head of Operations, Chief Investment Officer or General Counsel & Chief Legal Officer in writing. The ~~VPF~~ Head of Finance & Administration must then forward all items approved under this section to the President & CEO upon his/her return to the office and obtain approval from the President and CEO at that time.

6. All ARS requests will be reviewed by the ~~DOO~~ Head of Operations and ~~VPF~~ Head of Finance & Administration to ensure that the requested disbursement falls within the appropriate departmental budget for the current fiscal year prior to approval**.**

C. PSA duration and RFP requirements

1. Duration - The duration of PSAs for consulting or advisory services will generally not exceed one year without written approval of the President & CEO.

2. ~~-~~Whenever possible, an RFP is to be completed prior to entering into any contract in an amount over $150,000 in any one fiscal year.

3. Contractors with multiple contracts - CGB may engage the same contractor for several different projects or for continuations of a single project during a fiscal year. A PSA which will, if executed, result in cumulative expenditures to the contractor exceeding $150,000 in any one fiscal year will require, whenever possible, that an RFP be completed prior to the execution of the PSA.

D. Recordkeeping

1. The department of finance and administration will prepare and maintain a summary of all outstanding contracts. The summary will include the name of the contractor, a brief description of the services/project, the total amount of the contract and actual amount paid to date.

2. The ~~VPF~~ Head of Finance & Administration will be responsible for monitoring the status of approved contracts and ensuring that all contracts are in compliance with these operating procedures.

# Credit Card Policy and Procedures

## I. Purpose:

To provide procedures for the use of Connecticut Green Bank, ("CGB") owned credit cards by authorized employees of the CGB.

## II. Policy/Scope:

CGB owned credit cards will be issued to those employees who are designated as purchasing agents for CGB by the President and CEO. CGB owned credit cards will be used for official CGB business to purchase goods and services on behalf of CGB or to make travel arrangements on behalf of CGB employees who are traveling on CGB business. CGB owned credit cards shall not be used for personal or private business. Intentional misuse or fraudulent abuse of any CGB owned credit card may result in disciplinary action, up to and including dismissal. In addition, the authorized holder of the CGB owned credit card shall promptly reimburse CGB for any unacceptable or unauthorized purchases.

## III. Responsibility:

The ~~Vice President of Finance ("VPF")~~ Head of Finance & Administration shall be responsible for the administration of the CGB credit card account.

## IV. Procedures:

1. The President and CEO ("CEO") and the ~~Director of Operations ("DOO")~~ Head of Operations ~~-~~are authorized purchasing agents of the CGB. The CEO shall provide the ~~VPF~~ Head of Finance & Administration with a list of additional employees who are authorized purchasing agents for CGB. This list will be updated from time to time by the CEO as circumstances warrant. A credit card dollar limit will be approved by the CEO for each authorized purchasing agent.

2. The ~~VPF~~ Head of Finance & Administration as administrator of the CGB credit card account will approve and submit an application to the credit card issuer requesting that a card be issued (with the authorized dollar limit) to the CGB purchasing agent.

3. Once the CGB credit card is issued to the authorized purchasing agent, the purchasing agent will be responsible for maintaining adequate documentation supporting all purchases made with the credit card. This documentation shall be attached to the monthly credit card invoice and submitted to the ~~VPF~~ Head of Finance & Administration for review and approval. The ~~VPF~~ Head of Finance & Administration will review the documentation submitted to determine that the expenditure was for an appropriate business purpose.

The credit card invoice will be approved by the ~~VPF~~ Head of Finance & Administration and the Chief Legal ~~Officer (CLO)~~Counsel.

4. It is the purchasing agent's responsibility to monitor his or her account for unauthorized activity. All unauthorized activity should immediately be reported to the credit card issuer and ~~VPF~~ Head of Finance & Administration for appropriate action.

5. Purchasing agents who have been issued a CGB owned card will be responsible for safeguarding the card at all times. The purchasing agent is responsible for immediately and properly reporting a lost or stolen card to the credit card issuer and the ~~VPF~~ Head of Finance & Administration.

6. A copy of this policy will be provided to each purchasing agent. The purchasing agent will be required to acknowledge receipt of the policy.

# Mobile Device Policy and Reimbursement Procedure

## Policy

The Connecticut Green Bank ("CGB") often must have immediate access to key employees. Accordingly, CGB will provide mobile devices with cell and internet access to an employee if the employee's responsibilities require the employee to be out of the office on Company business and the employee needs to be in contact with CGB staff or its partners during that time.

## Procedure

Mobile device plans bundle "voice" minutes and "data" minutes for a monthly fee.

Employees can be reimbursed for the associated monthly voice and data charges by submitting an approved employee expense report with appropriate backup including dates of service to the accounting department on a monthly basis up to the limit established by the organization. If an employee's cell phone service is part of a "family" plan, the employee will only be reimbursed for the charges allocated to their cell phone number. Dollar limits will be reviewed and adjusted periodically by the President and CEO and the ~~Director of Operations ("DOO")~~ Head of Operations. Pre-Approval forms may be obtained from the accounting department. All requests for mobile communications devices and associated voice/data plans must be approved by the ~~DOO~~ Head of Operations. ***Charges incurred that were not pre-approved or above the pre-approved limit will be the responsibility of the employee.***

Costs outside of this procedure will be reviewed on a case by case basis and should seek pre-approval whenever possible.

CGB -105
Revised ~~July 21,~~ ~~2017~~January 17,2023

# Fixed Assets and Depreciation

**I. Purpose:** To set policy and controls over the recording of fixed assets related depreciation.

**II. Scope**: This policy applies to all purchases of furniture, equipment, software and leasehold improvements.

**III. Responsibility:** The Head of Finance & Administration and Controller are~~is~~ responsible for monitoring and tracking fixed assets and related depreciation.

**IV. Procedure:**

a. All computer hardware and software, office furniture and equipment, and leasehold improvement items purchased with a value greater than $1,000 are capitalized and recorded as fixed assets.

b. The Staff Accountant or Senior Accountant records the fixed asset vendor invoice to the appropriate fixed asset account. Invoices are approved using internal accounting control procedure CGB 101 – Purchasing and Accounts Payable.

c. The Senior Accountant, Controller, or Head of Finance & Administration reviews fixed asset purchases on a monthly basis and inputs the appropriate financial information in the Intacct business system using the following categories and useful lives:

    i. Furniture and Equipment – 5 years
    ii. Computer Hardware – 3 years
    iii. Computer Software – 3 or 2 years
    iv. Leasehold Improvements – 5 years or life of lease, whichever is less

d. Depreciation is calculated by Intacct using the straight-line method on a yearly basis and reconciled monthly.

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CONNECTICUT GREEN BANK

# Memo

**To:** Connecticut Green Bank Board of Directors

**From:** Bryan Garcia (President and CEO), Jane Murphy (Executive Vice President of Finance and Administration), Eric Shrago (Vice President of Operations), & Dan Smith (Associate Director of Finance and Administration)

**Date:** January 13, 2023

**Re:** Proposed updates to FY2023 Targets and Budget

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As the Board of Directors is well aware, we typically review our budget and targets mid-way through our fiscal year and look to bring those in line with what we are seeing in the market and what we think we will need to achieve those targets. This year, in light of the passage of the Inflation Reduction Act of 2022, and the expected boost that the incentives included in it will bring to the green economy, we have started to think about how we can scale our programs to support further demand. We do not expect the IRA to impact FY2023 targets and we will be presenting our budget requests in two parts: the standard revision and then a dream big scenario where we are gearing up with an expectation of increased demand.

On January 11, staff presented the changes in this memo to the Budget. Operations, and Compensation committee and the committee has recommended that the Board approve (1) the revised FY2023 Targets and Budget, (2) the addition of the Dream Bigger Strategy and budget, and (3) extend the professional services agreements (PSAs) with Inclusive Prosperity Capital for fiscal year 2023 with the amounts of each PSA not to exceed the applicable approved budget line item.

## I. Targets

After two quarters of assessing program performance and market conditions, the Green Bank staff has proposed the following adjustments to targets for this fiscal year:

- Changes to the Incentive Programs targets include:
    - We seek to clarify the way we count projects against our targets for Energy Storage Solutions. We are proposing that our target should be for projects approved/closed by the Green Bank as that is where our control over those projects ends. Previously we had proposed counting projects only when they are completed, that is, when batteries are energized and interconnected with

the grid; however, due to delays in equipment and with interconnection approval processes, we expect considerable lag between the time a project is approved and the time the project is completed. We want to be more transparent and will report out both numbers in terms of what has been approved and what has been completed, however our targets will be based on approved projects.

  - With that change in mind, we are stating the new targets for FY23 for Energy Storage Solutions to be 380 projects worth $82.375 Million in capital deployed with a name plate capacity of 49.7 MW. These new targets represent an overall decrease in the number of projects for the year (a result of slower than expected residential uptake), but an increase in the capital deployed and numbers of commercial and industrial projects.
  - Targets for Smart-E remain flat.

- Changes to the Financing Programs Targets include:
  - Overall targets for number of projects, capital deployed and capacity installed are the same.
  - We are clarifying CGB capital invested target which had previously been stated as $37.4 million. We are clarifying that this target should be $13.42 million.

The targets are summarized in the following tables:

**Table 1. Proposed FY 2023 Targets for the Incentive Programs Business Unit**

| Segment | Program | Targets | | | |
|---|---|---|---|---|---|
| | | Number of Projects | Total Capital Deployed | | Capacity Installed/ Nameplate Capacity |
| Incentive Programs | *Residential Storage Incentives Total* | 350 | 14,875,000 | | 4.7 |
| | *C&I Storage Incentives Total* | 30 | 67,500,000 | | 45.0 |
| | **Total Battery Storage** | **380** | **$82,375,000** | | **49.7** |
| | **Total Smart-E** | **960** | **$14,994,623** | | **0.2** |
| | **Incentive Programs Total** | **1,340** | **$97,369,623** | | **49.9** |

**Table 2. Proposed FY 2023 Targets for the Financing Programs Business Unit**

| Segment | Product | Targets | | | |
|---|---|---|---|---|---|
| | | Number of Projects | Total Capital Deployed | CGB Capital Deployed | Capacity Installed |
| Financing Programs | CPACE | 23 | $31,000,000 | $7,000,000 | 0.0 |
| | PPA/RoofLeases | 19 | $13,710,000 | $2,700,000 | 7.6 |
| | SBEA | 839 | $18,600,000 | $3,720,000 | |
| | Multi-Family Pre-Dev | 0 | $0 | | 0.0 |
| | Multi-Family Term | 6 | $1,380,000 | $0 | 0.6 |
| | Multi-Family Health and Safety Total | 1 | $892,500 | | |
| | Transportation | 0 | 0 | | 0 |
| | Strategic Investments | 0 | $0 | | 0.0 |
| | Financing Programs Total | 882 | $ 64,202,500 | $ 13,420,000 | 7.6 |

## II. Proposed Changes to the Green Bank Investment and Operating Budgets – Standard Revisions

The overall net proposed budget represents an increase in expenses of $880,831 and a decrease in revenue of $1,645,239. Staff proposes a decrease in non-operating expenses of $5.6 million. The proposed updated budget differs from the original, approved budget in the following ways:

### Financing Programs

The Green Bank is proposing adjusting the Financing Programs revenue downward by $1,645,239 based on Utility Customer Assessments income being $328,613 higher than expected (Adjustment A in the attachment) but this is offset by RGGI auction Proceeds being $1,973,852 lower than forecast (Adjustment B in the attachment). The RGGI proceeds is due to the organization reaching the statutorily mandated cap, the first time this has occurred.

Staff also proposes additional expenses of $821,561 the Financing Programs. $116,061 of this increase is driven by the reallocation of staff and the creation of a part-time position in the investment team. This offsets consulting expenses as the person filling this position was previously a consultant. (Adjustment C in the attachment which is offset by adjustment G). There are an addition of $205k of technology costs related to the further implementation of Salesforce across the organization (Adjustment D). There is an increase of $25K in EM&V to cover an ongoing project related to CPACE customer savings (part of adjustment E).

We are also proposing an increase in Research and Development expenses of $315K. This is driven primarily by the support for the statutorily mandated Hydrogen Task Force and work to support the deployment of electric school busses (Adjustment F).

### Incentive Programs

Staff proposes $59,404 of additional expenses in the Incentive Programs for the impact study we are working on as part of statutorily mandated report to the legislature for RSIP. (Part of adjustment E). Staff propose increasing the Research and development budget related to

Energy Storage Solutions by $179K driven by battery end of life and front of the meter deployment (Adjustment F).

Additionally, we are reducing the incentives we expect to pay this fiscal year by $5,626,314. $4,853,042 of this is driven by holdbacks from third parties who have not upgraded meters (adjustment H) and $772K is due to slower deployment of batteries under ESS (Adjustment I).

**Environmental Infrastructure**
Staff are proposing changes to the budget to increase the Research and development budget in support of the further rollout of the expanded mission of $26K (part of adjustment F).

## III. Dream Big Strategy

In preparation for increased demand resulting from the incentives in the Inflation Reduction Act, staff have gone through a brainstorming process on how we can take advantage of this opportunity to further enable projects coming to fruition. We have worked in teams that are focused on what is needed from a policy, products, people, promotion, and place perspectives. We have looked at what gaps exist and what is needed to address those. While this is an ongoing process, there are some budgetary implications and we are proposing some additional budget requests associated with this effort. We ask you view these separately from those above as these are more focused on how we scale the organization and take it to the next level.

The budget recommendations from the working groups on the different dream big pillars are:

- Onboard 5 additional staff members focused on project acquisition by the end of this fiscal year. 4 of these team members would be in the financing programs segment with 3 on the financing programs team and 1 on the operations team with a data analytics/GIS/marketing focus. The remaining position would be to support our residential efforts (ESS and Smart-E), which roll up to the incentive programs. The cost of these positions would be $252,115 for this fiscal year.
- An additional $50,000 to help create marketing assets that facilitate a greater reach to the public specifically on the residential side.
- An additional $50,000 added to the rent budget to support efforts by the Green Bank to connect in communities to the populations we are trying to reach.

## IV. Strategic Partners

As you recall, the board instructed staff to contract with 16 strategic partners in June 2022 with specific not-to-exceed thresholds. However, we seek to clarify the resolution from June from the Board and request a renewed recommendation from the committee at this time with regard to Inclusive Prosperity Capital.

**Resolution 2:**

**WHEREAS,** per Section 5.2.2 of the Bylaws of the Connecticut Green Bank, ~~'s requires the recommendation of~~ the Budget, Operations, and Compensation Committee of Board of Directors recommends that the board approve (1) the revised FY2023 Targets and Budget, (2) the addition of the Dream Bigger Strategy and budget, and (3) extend the professional services agreements (PSAs) with Inclusive Prosperity Capital for fiscal year 2023 with the amounts of each PSA not to exceed the applicable approved budget line item~~the annual budget to the Connecticut Green Bank Board of Directors~~;

**NOW**, therefore be it:

**RESOLVED**, that the ~~Budget Operations, and Compensation Committee Green Bank Board hereby recommends approval to the~~ Board of Directors approves the: (1) the revised FY2023 Targets and Budget, (2) the addition of the Dream Bigger Strategy and budget, and (3) the ~~exten~~extension of~~d~~ the professional services agreements (PSAs) with Inclusive Prosperity Capital for fiscal year 2023 with the amounts of each PSA not to exceed the applicable approved budget line item.

# Connecticut Green Bank

Fiscal Year Budget - Recast vs. Original

| | Fiscal Year Jun 30 2023 | | | Incentive Programs Fiscal Year Jun 30 2023 | | | Financing Programs Fiscal Year Jun 30 2023 | | | Environmental Infrastructure Fiscal Year Jun 30 2023 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Recast Budget | FY23 Original Budget | Variance | Recast Budget | FY23 Original Budget | Variance | Recast Budget | FY23 Original Budget | Variance | Recast Budget | FY23 Original Budget | Variance |
| **Revenue** | | | | | | | | | | | | |
| Operating Income | | | | | | | | | | | | |
| Utility Customer Assessments | 24,737,413 | 24,408,800 | 328,613 {A} | 0 | 0 | 0 | 24,737,413 | 24,408,800 | 328,613 | 0 | 0 | 0 |
| RGGI Auction Proceeds-Renewables | 8,910,288 | 10,884,140 | (1,973,852) {B} | 0 | 0 | 0 | 8,910,288 | 10,884,140 | (1,973,852) | 0 | 0 | 0 |
| CPACE Closing Fees | 123,000 | 123,000 | 0 | 0 | 0 | 0 | 123,000 | 123,000 | 0 | 0 | 0 | 0 |
| REC Sales | 13,917,136 | 13,917,136 | 0 | 12,450,636 | 12,450,636 | 0 | 1,466,500 | 1,466,500 | 0 | 0 | 0 | 0 |
| Grant Income-Federal Programs | 40,000 | 40,000 | 0 | 0 | 0 | 0 | 40,000 | 40,000 | 0 | 0 | 0 | 0 |
| PPA Income | 465,000 | 465,000 | 0 | 0 | 0 | 0 | 465,000 | 465,000 | 0 | 0 | 0 | 0 |
| LREC/ZREC Income | 325,000 | 325,000 | 0 | 0 | 0 | 0 | 325,000 | 325,000 | 0 | 0 | 0 | 0 |
| Total Operating Income | 48,517,837 | 50,163,076 | (1,645,239) | 12,450,636 | 12,450,636 | 0 | 36,067,201 | 37,712,440 | (1,645,239) | 0 | 0 | 0 |
| Interest Income | 6,158,000 | 6,158,000 | 0 | 53,400 | 53,400 | 0 | 6,104,600 | 6,104,600 | 0 | 0 | 0 | 0 |
| Interest Income, Capitalized | 48,000 | 48,000 | 0 | 0 | 0 | 0 | 48,000 | 48,000 | 0 | 0 | 0 | 0 |
| Other Income | 404,535 | 404,535 | 0 | 0 | 0 | 0 | 404,535 | 404,535 | 0 | 0 | 0 | 0 |
| **Total Revenue** | **$ 55,128,372** | **$ 56,773,611** | **(1,645,239)** | **$ 12,504,036** | **$ 12,504,036** | **0** | **$ 42,624,336** | **$ 44,269,575** | **(1,645,239)** | **$ 0** | **$ 0** | **0** |
| **Operating Expenses** | | | | | | | | | | | | |
| Compensation and Benefits | | | | | | | | | | | | |
| Employee Compensation | 6,345,292 | 6,279,476 | 65,816 {C} | 1,773,334 | 1,773,648 | (314) | 4,247,357 | 4,181,157 | 66,200 | 324,600 | 324,671 | (71) |
| Employee Benefits | 5,618,380 | 5,568,865 | 49,515 {C} | 1,555,419 | 1,555,702 | (282) | 3,770,821 | 3,720,960 | 49,861 | 292,140 | 292,203 | (63) |
| Total Compensation and Benefits | 11,963,672 | 11,848,341 | 115,331 {C} | 3,328,753 | 3,329,350 | (596) | 8,018,178 | 7,902,117 | 116,061 | 616,740 | 616,874 | (134) |
| Program Development & Administration | 4,828,766 | 4,623,266 | 205,500 {D} | 3,492,000 | 3,492,000 | 0 | 936,766 | 731,266 | 205,500 | 400,000 | 400,000 | 0 |
| Program Administration-IPC Fee | 1,366,220 | 1,366,220 | 0 | 317,022 | 317,022 | 0 | 1,049,198 | 1,049,198 | 0 | 0 | 0 | 0 |
| Lease Origination Services | 4,000 | 4,000 | 0 | 0 | 0 | 0 | 4,000 | 4,000 | 0 | 0 | 0 | 0 |
| Marketing Expense | 1,750,165 | 1,750,165 | 0 | 528,066 | 528,066 | 0 | 1,222,099 | 1,222,099 | 0 | 0 | 0 | 0 |
| E M & V | 1,048,000 | 963,000 | 85,000 {E} | 843,000 | 783,000 | 60,000 | 205,000 | 180,000 | 25,000 | 0 | 0 | 0 |
| Research and Development | 720,000 | 200,000 | 520,000 {F} | 179,000 | 0 | 179,000 | 415,000 | 100,000 | 315,000 | 126,000 | 100,000 | 26,000 |
| Consulting and Professional Fees | | | | | | | | | | | | |
| Consulting/Advisory Fees | 975,700 | 1,020,700 | (45,000) {G} | 520,100 | 520,100 | 0 | 455,600 | 500,600 | (45,000) | 0 | 0 | 0 |
| Accounting and Auditing Fees | 318,350 | 318,350 | 0 | 0 | 0 | 0 | 318,350 | 318,350 | 0 | 0 | 0 | 0 |
| Legal Fees & Related Expenses | 242,000 | 242,000 | 0 | 60,000 | 60,000 | 0 | 182,000 | 182,000 | 0 | 0 | 0 | 0 |
| Total Consulting and Professional Fees | 1,536,050 | 1,581,050 | (45,000) | 580,100 | 580,100 | 0 | 955,950 | 1,000,950 | (45,000) | 0 | 0 | 0 |
| Rent and Location Related Expenses | | | | | | | | | | | | |
| Rent/Utilities/Maintenance | 308,716 | 308,716 | 0 | 87,198 | 87,198 | 0 | 205,557 | 205,557 | 0 | 15,962 | 15,962 | 0 |
| Telephone/Communication | 56,400 | 56,400 | 0 | 15,931 | 15,930 | 0 | 37,553 | 37,553 | 0 | 2,916 | 2,916 | 0 |
| Depreciation & Amortization | 673,314 | 673,314 | 0 | 48,767 | 48,767 | 0 | 615,621 | 615,621 | 0 | 8,926 | 8,926 | 0 |
| Total-Rent and Location Related Expenses | 1,038,430 | 1,038,430 | 0 | 151,894 | 151,895 | 0 | 858,731 | 858,731 | 0 | 27,804 | 27,804 | 0 |
| Office, Computer & Other Expenses | 1,780,265 | 1,780,265 | 0 | 513,204 | 513,204 | 0 | 1,227,301 | 1,227,301 | 0 | 39,760 | 39,760 | 0 |
| **Total Operating Expenses** | **26,035,567** | **25,154,737** | **880,831** | **9,933,040** | **9,694,637** | **238,404** | **14,892,223** | **14,275,662** | **616,561** | **1,210,304** | **1,184,438** | **25,866** |
| **Program Incentives and Grants** | | | | | | | | | | | | |
| Financial Incentives-CGB Grants | 5,185,000 | 5,185,000 | 0 | 60,000 | 60,000 | 0 | 5,125,000 | 5,125,000 | 0 | 0 | 0 | 0 |
| Program Expenditures-Federal Grants | 40,000 | 40,000 | 0 | 0 | 0 | 0 | 40,000 | 40,000 | 0 | 0 | 0 | 0 |
| EPBB/PBI/HOPBI Incentives | 9,396,958 | 14,250,000 | (4,853,042) {H} | 9,396,958 | 14,250,000 | (4,853,042) | 0 | 0 | 0 | 0 | 0 | 0 |
| Battery Storage Incentives | 1,657,012 | 2,430,284 | (773,272) {I} | 1,657,012 | 2,430,284 | (773,272) | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Program Incentives and Grants** | **$ 16,278,970** | **$ 21,905,284** | **(5,626,314)** | **$ 11,113,970** | **$ 16,740,284** | **(5,626,314)** | **$ 5,165,000** | **$ 5,165,000** | **0** | **$ 0** | **$ 0** | **0** |
| **Operating Income/(Loss)** | **$ 12,813,835** | **$ 9,713,590** | **3,100,244** | **$ (8,542,974)** | **$ (13,930,885)** | **5,387,910** | **$ 22,567,113** | **$ 24,828,913** | **(2,261,800)** | **$ (1,210,304)** | **$ (1,184,438)** | **(25,866)** |
| **Non-Operating Expenses** | | | | | | | | | | | | |
| Interest Expense | 2,554,641 | 2,554,641 | 0 | 2,384,909 | 2,384,909 | 0 | 169,732 | 169,732 | 0 | 0 | 0 | 0 |
| Provision for Loan Loss | 2,333,000 | 2,333,000 | 0 | 0 | 0 | 0 | 2,333,000 | 2,333,000 | 0 | 0 | 0 | 0 |
| Interest Rate Buydowns-ARRA | 600,000 | 600,000 | 0 | 600,000 | 600,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Non-Operating Expenses** | **$ 5,487,641** | **$ 5,487,641** | **0** | **$ 2,984,909** | **$ 2,984,909** | **0** | **$ 2,502,732** | **$ 2,502,732** | **0** | **$ 0** | **$ 0** | **0** |
| **Net Revenues Over (Under) Expenses** | **7,326,194** | **4,225,950** | **3,100,244** | **(11,527,883)** | **(16,915,793)** | **5,387,910** | **20,064,381** | **22,326,181** | **(2,261,800)** | **(1,210,304)** | **(1,184,438)** | **(25,866)** |

*See budget memo for details of adjustments (A) through (I).*

# Connecticut Green Bank

Fiscal Year Budget - Recast vs. Original & Dream Big vs Recast

| | Fiscal Year Jun 30 2023 | | | | |
|---|---|---|---|---|---|
| | Recast Budget | FY23 Original Budget | Variance | Dream Big Recast Budget | Variance to Recast Budget |
| **Revenue** | | | | | |
| Operating Income | | | | | |
| Utility Customer Assessments | 24,737,413 | 24,408,800 | 328,613 {A} | 24,737,413 | 0 |
| RGGI Auction Proceeds-Renewables | 8,910,288 | 10,884,140 | (1,973,852) {B} | 8,910,288 | 0 |
| CPACE Closing Fees | 123,000 | 123,000 | 0 | 123,000 | 0 |
| REC Sales | 13,917,136 | 13,917,136 | 0 | 13,917,136 | 0 |
| Grant Income-Federal Programs | 40,000 | 40,000 | 0 | 40,000 | 0 |
| PPA Income | 465,000 | 465,000 | 0 | 465,000 | 0 |
| LREC/ZREC Income | 325,000 | 325,000 | 0 | 325,000 | 0 |
| Total Operating Income | 48,517,837 | 50,163,076 | (1,645,239) | 48,517,837 | 0 |
| Interest Income | 6,158,000 | 6,158,000 | 0 | 6,158,000 | 0 |
| Interest Income, Capitalized | 48,000 | 48,000 | 0 | 48,000 | 0 |
| Other Income | 404,535 | 404,535 | 0 | 404,535 | 0 |
| **Total Revenue** | **$ 55,128,372** | **$ 56,773,611** | **(1,645,239)** | **$ 55,128,372** | **$ 0** |
| **Operating Expenses** | | | | | |
| Compensation and Benefits | | | | | |
| Employee Compensation | 6,345,292 | 6,279,476 | 65,816 {C} | 6,477,984 | (132,692) {C1} |
| Employee Benefits | 5,618,380 | 5,568,865 | 49,515 {C} | 5,737,803 | (119,423) {C1} |
| Total Compensation and Benefits | 11,963,672 | 11,848,341 | 115,331 {C} | 12,215,787 | (252,115) {C1} |
| Program Development & Administration | 4,828,766 | 4,623,266 | 205,500 {D} | 4,828,766 | 0 |
| Program Administration-IPC Fee | 1,366,220 | 1,366,220 | 0 | 1,366,220 | 0 |
| Lease Origination Services | 4,000 | 4,000 | 0 | 4,000 | 0 |
| Marketing Expense | 1,750,165 | 1,750,165 | 0 | 1,800,165 | (50,000) {J} |
| E M & V | 1,048,000 | 963,000 | 85,000 {E} | 1,048,000 | 0 |
| Research and Development | 720,000 | 200,000 | 520,000 {F} | 720,000 | 0 |
| Consulting and Professional Fees | | | | | |
| Consulting/Advisory Fees | 975,700 | 1,020,700 | (45,000) {G} | 975,700 | 0 |
| Accounting and Auditing Fees | 318,350 | 318,350 | 0 | 318,350 | 0 |
| Legal Fees & Related Expenses | 242,000 | 242,000 | 0 | 242,000 | 0 |
| Total Consulting and Professional Fees | 1,536,050 | 1,581,050 | (45,000) | 1,536,050 | 0 |
| Rent and Location Related Expenses | | | | | |
| Rent/Utilities/Maintenance | 308,716 | 308,716 | 0 | 358,716 | (50,000) {K} |
| Telephone/Communication | 56,400 | 56,400 | 0 | 56,400 | 0 |
| Depreciation & Amortization | 673,314 | 673,314 | 0 | 673,314 | 0 |
| Total-Rent and Location Related Expenses | 1,038,430 | 1,038,430 | 0 | 1,088,430 | (50,000) |
| Office, Computer & Other Expenses | 1,780,265 | 1,780,265 | 0 | 1,780,265 | 0 |
| **Total Operating Expenses** | **26,035,567** | **25,154,737** | **880,831** | **26,387,683** | **(352,116)** |
| **Program Incentives and Grants** | | | | | |
| Financial Incentives-CGB Grants | 5,185,000 | 5,185,000 | 0 | 5,185,000 | 0 |
| Program Expenditures-Federal Grants | 40,000 | 40,000 | 0 | 40,000 | 0 |
| EPBB/PBI/HOPBI Incentives | 9,396,958 | 14,250,000 | (4,853,042) {H} | 9,396,958 | 0 |
| Battery Storage Incentives | 1,657,012 | 2,430,284 | (773,272) {I} | 1,657,012 | 0 |
| **Total Program Incentives and Grants** | **$ 16,278,970** | **$ 21,905,284** | **(5,626,314)** | **$ 16,278,970** | **$ 0** |
| **Operating Income/(Loss)** | **$ 12,813,835** | **$ 9,713,590** | **3,100,244** | **$ 12,461,719** | **$ 352,116** |
| **Non-Operating Expenses** | | | | | |
| Interest Expense | 2,554,641 | 2,554,641 | 0 | 2,554,641 | 0 |
| Provision for Loan Loss | 2,333,000 | 2,333,000 | 0 | 2,333,000 | 0 |
| Interest Rate Buydowns-ARRA | 600,000 | 600,000 | 0 | 600,000 | 0 |
| **Total Non-Operating Expenses** | **$ 5,487,641** | **$ 5,487,641** | **0** | **$ 5,487,641** | **$ 0** |
| **Net Revenues Over (Under) Expenses** | **7,326,194** | **4,225,950** | **3,100,244** | **6,974,078** | **352,116** |

*See budget memo for details of adjustments (A) through (K).*

CONNECTICUT
GREEN BANK®

# Comprehensive Plan Fiscal Year 2023


# Comprehensive Plan

## Fiscal Year 2023

## Green Bonds US

**July 2022**

**January 2023 (Revised)**

# Table of Contents

# 1. Executive Summary

The past two years have been some of the most challenging in living memory.

The COVID-19 pandemic upended the world. In Connecticut alone, there have been over 833,000 confirmed COVID-19 cases and more than eleven thousand COVID-19 associated deaths.[1] We were forced to quickly adapt to new safety precautions, changing how we work with our partners and interact with our customers. Global supply chains have faced massive disruptions, including international shipping delays that delayed the arrival of clean energy technology required to support our programs. In the past six months, global armed conflict in Ukraine instigated by Russia has sent further shockwaves through the supply chain and energy markets. These and other emergencies have drawn political attention away from the climate crisis while increasingly violent storms, drought, wildfires, flooding and other climate-related catastrophes sweep the planet.

The most recent update from the United Nations on progress towards the Sustainable Development Goals[2] paints a bleak picture: to avoid the worst effects of climate change, global GHG emissions will "need to peak before 2025 and then decline by 43% by 2030, falling to net zero by 2050. Instead under current voluntary national commitments to climate action, greenhouse gas emissions will ***rise*** [emphasis added] by nearly 14 percent by 2030."

Here in the United States, we witnessed historical ~~have only seen marginal~~ progress made at the federal level towards changing our emissions trajectory towards 40% reduction from 2005 levels by 2030. In November 2021, the US Congress enacted the Infrastructure Investment and Jobs Act ("IIJA"), also called the Bipartisan Infrastructure Law ("BIL"). The $1.2 trillion act established and refunded programs to support new infrastructure over a 10-year period. The Act contains research and development funds for low-carbon energy technology and support for deployment of clean energy technology such as electric vehicles. In fact, the largest portion of this investment will be overseen by the Department of Transportation.[3] And in August 2022, the US Congress reached a deal on budget reconciliation and enacted the Inflation Reduction Act ("IRA"). The IRA is a landmark federal law which aims to curb inflation, including the single most significant legislation to combat climate change in our nation's history investing a total of $369 billion to help build the clean energy economy through incentives and tax credits, including the creation of a $27 billion Greenhouse Gas Reduction Fund ("GHGRF") modelled after the Connecticut Green Bank ("Green Bank").[4]

~~However, the fate of IIJA's sister bill, the Build Back Better bill, remains uncertain. Without the additional funding of clean energy and transportation (including new tax credits) included in the Build Back Better bill, it is unlikely that the United States will be able to achieve President Biden's goal of cutting national greenhouse gas emissions to 50 percent below 2005 levels by 2030.~~

[1] COVID-19 data resources | Connecticut Data
[2] The-Sustainable-Development-Goals-Report-2022.pdf (un.org)
[3] The US Bipartisan Infrastructure Law: Breaking it down | McKinsey
[4] https://www.ctgreenbank.com/connecticut-green-bank-the-countrys-first-state-green-bank-salutes-u-s-congress-and-president-biden-for-passage-and-signage-of-inflation-reduction-act/

Here in Connecticut, the ~~Connecticut~~ Green Bank ~~("Green Bank")~~ continues to seek solutions that can accelerate progress towards the state decarbonization goals established in the 2008 Global Warming Solutions Act ("GWSA") and our investments are making a measurable difference, but greater public and private investment in and deployment of clean energy is needed. In the 10 years of its existence, the Green Bank has helped avoid nearly 10 million tons of carbon dioxide emissions (the equivalent of 2.1 million passenger vehicles driven for one year).[5] Avoiding 1 million tons of carbon dioxide emissions a year, for a state that emits over 40 million tons per year, is just over 2 percent of all emissions avoided, or over 10 percent of emissions avoided from electricity generation (and consumption).

Connecticut is not on track to achieve 2030 and 2050 targets established in the GWSA.[6] The 2018 Connecticut Greenhouse Gas Emissions Inventory, released in 2021 by the Connecticut Department of Energy and Environmental Protection ("DEEP"),[7] revealed that while emissions have fallen 7.3% from a 1990 baseline, there was in fact a slight increase in emissions in 2018 over 2017 emissions.

In response to this, and to growing threats from severe storms, rain bombs, heat domes, polar vortexes, and rising sea levels, on July 6, 2021, Governor Ned Lamont, with the support of the Governor's Council on Climate Change, signed into law Public Act 21-115.[8] This act expanded the Green Bank mandate to include environmental infrastructure – a recognition that the same financing tools we have successfully leveraged to increase investment in and deployment of clean energy in Connecticut can support other environmental sectors in need of rapid transformation as well. The act includes the creation of an Environmental Infrastructure Fund which could receive federal funds (e.g., GHGRF) to mobilize private investment in environmental infrastructure.

Liu Zhenmin, the United Nations Under-Secretary-General for Economic and Social Affairs, concludes his comments on the annual SDG report with the following guidance: "Nothing short of a comprehensive transformation of the international finance and debt architecture will be required to accomplish these aims…"

Although the Green Bank is geographically limited in our ability to invest in resilience and mitigation to confront climate change, we can continue to be a leader in the space and demonstrate how new financing models through public-private partnerships can drive innovative investment in our global future.[9] Since the Green Bank's launch in 2011 as the first green bank in the nation, dozens of state and local green banks have popped up both nationally and abroad. With the IIJA and the IRA in place at the federal level, and the public policies and incentives available in Connecticut, the Green Bank is poised to continue its leadership and advance its mission.

~~Perhaps t~~The old adage of "think globally – act locally" is appropriate – "let's go!"

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[5] https://www.ctgreenbank.com/wp-content/uploads/2022/09/FY12-FY22-CGB-ImpactReport-8242022.pdf ~~https://www.ctgreenbank.com/wp-content/uploads/2021/12/FY12-FY21-CGB-ImpactReport-web.pdf~~

[6] Reduce GHG emissions by 45% from 2001 levels by 2030 and 80% from 2001 levels by 2050

[7] https://portal.ct.gov/-/media/DEEP/climatechange/GHG_Emissions_Inventory_2018.pdf

[8] An Act Concerning Climate Change Adaptation – https://www.cga.ct.gov/2021/ACT/PA/PDF/2021PA-00115-R00HB-06441-PA.PDF

[9] "There's finally a national climate bank. Here's how it can make its $27 billion go even further" in Fast Company by Ashley Stimpson (December 16, 2022)

## 2. Organizational Overview

The Green Bank[10] was established on a bipartisan basis by Governor Malloy and the Connecticut General Assembly ("CGA") on July 1, 2011 through Public Act ("PA") 11-80[11] as a quasi-public agency that supersedes the former Connecticut Clean Energy Fund ("CCEF"). On July 1, 2021, the 10th anniversary of the Green Bank, again, on a bipartisan basis, Governor Lamont and the CGA enacted PA 21-115 expanding the scope of the Green Bank beyond "clean energy" to include "environmental infrastructure". As the nation's first state green bank, the Green Bank leverages public funds to mobilize multiples of private investment to increase and accelerate investment in clean energy deployment and environmental infrastructure improvement in Connecticut.

The Green Bank's statutory purposes are:

- To develop programs to finance and otherwise support clean energy and environmental infrastructure investment in residential, municipal, small business and larger commercial projects and such other programs as the Green Bank may determine;

- To support financing or other expenditures that promote investment in clean energy sources and environmental infrastructure to foster the growth, development and commercialization of clean energy sources, environmental infrastructure, and related enterprises; and

- To stimulate demand for clean energy and the deployment of clean energy sources and investment in environmental infrastructure within the state that serves end-use customers in the state.

The Green Bank's purposes are codified in Section 16-245n(d)(1) of the Connecticut General Statutes ("CGS") and restated in the Green Bank's Board approved Resolution of Purposes. The Green Bank is a public policy innovation that exemplifies Connecticut's more than two-decade history of bipartisan executive and legislative branch leadership on the issue of climate change. Leadership highlights include:

- **Governor Rowland** – co-chaired the New England Governors and Eastern Canadian Premiers Conference, which established a regional commitment to reduce greenhouse gas ("GHG") emissions (i.e., 1990 levels by 2010, 10% below 1990 levels by 2020, and 80% below 2001 levels by 2050);[12]

- **Governor Rell** – supported PA 08-98[13] codifying the regional commitment into state law, appointing Gina McCarthy to be the Commissioner of the Department of

[10] PA 11-80 repurposed the Connecticut Clean Energy Fund (CCEF) administered by Connecticut Innovations, into a separate quasi-public organization called the Clean Energy Finance and Investment Authority (CEFIA). Per Public Act 14-94, CEFIA was renamed to the Connecticut Green Bank.

[11] An Act Concerning the Establishment of the Department of Energy and Environmental Protection and Planning for Connecticut's Energy Future – https://www.cga.ct.gov/2011/act/pa/pdf/2011PA-00080-R00SB-01243-PA.pdf

[12] NEG-ECP Resolution 26-4 adopting the "Climate Change Action Plan 2001" (August 2001 in Westbrook, CT) – Westbrook Resolution

[13] An Act Concerning Connecticut Global Warming Solutions – https://www.cga.ct.gov/2008/ACT/Pa/pdf/2008PA-00098-R00HB-05600-PA.pdf

Environmental Protection who would help lead the development of the Regional Greenhouse Gas Initiative ("RGGI"), later become the Administrator of the United States Environmental Protection Agency ("USEPA") under President Obama, and becoming the White House National Climate Advisor for President Biden;

- **Governor Malloy** – led the passage of PA 11-80 establishing DEEP, creating the Green Bank, and other policies catalyzing the market for clean energy, as well as PA 18-50[14] and PA 18-82[15] increasing the state's renewable portfolio standard ("RPS") to 40% by 2030 and establishing a midterm GHG emissions reduction target of 45% below 2001 levels by 2030, respectively; and

- **Governor Lamont** – issued his first[16] and third[17] executive orders on state "Greener Gov" for sustainability, clean energy, and climate change leadership, passing PA 21-115 expanding the scope of the Green Bank to include "environmental infrastructure," PA 22-5[18] including a 100% zero emission electricity target by 2040, and PA 22-25[19] confronting greenhouse gas emissions from the transportation sector, including 100% targets for school buses in environmental justice communities by 2030 and all communities by 2040.

The CGA has worked hand-in-hand with these Governors and the citizens of the state over the years to devise and support public policies that promote clean energy, environmental infrastructure, and lead the movement to confront climate change.[20]

## 2.1 Vision Statement

…a planet protected by the love of humanity.[21]

## 2.2 Mission Statement

Confront climate change by increasing and accelerating investment into Connecticut's green economy to create more resilient, healthier, and equitable communities.

## 2.3 Goals

To achieve its vision and mission, the Green Bank has established the following three goals:

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[14] An Act Concerning Connecticut's Energy Future – https://www.cga.ct.gov/2018/act/pa/pdf/2018PA-00050-R00SB-00009-PA.pdf

[15] An Act Concerning Climate Change Planning and Resiliency – https://www.cga.ct.gov/2018/act/pa/pdf/2018PA-00082-R00SB-00007-PA.pdf

[16] https://portal.ct.gov/-/media/Office-of-the-Governor/Executive-Orders/Lamont-Executive-Orders/Executive-Order-No-1.pdf

[17] https://portal.ct.gov/-/media/Office-of-the-Governor/Executive-Orders/Lamont-Executive-Orders/Executive-Order-No-3.pdf

[18] An Act Concerning Climate Change Mitigation – https://www.cga.ct.gov/2022/act/Pa/pdf/2022PA-00005-R00SB-00010-PA.PDF

[19] An Act Concerning the Connecticut Clean Air Act – https://www.cga.ct.gov/2022/ACT/PA/PDF/2022PA-00025-R00SB-00004-PA.PDF

[20] Reducing greenhouse gas emissions and confronting climate change is supported by a number of public policies, including, but not limited to PA 17-3, PA 18-82, PA 19-71, Governor Lamont's Executive Orders 1 and 3, Comprehensive Energy Strategy, Governor's Council on Climate Change, and many other past acts, plans, or policies.

[21] Vision Statement inspired by the Innovations in American Government Awards at the Ash Center of Harvard University's Kennedy School of Government, Maya Angelou's "On the Pulse of Morning," the powerful words of Mary Evelyn Tucker on "inclusive capitalism," and Mother Jennifer of the Daughters of Mary of the Immaculate Conception

1. To leverage limited public resources to scale-up and mobilize private capital investment in the green economy of Connecticut.

2. To strengthen Connecticut's communities, especially vulnerable communities,[22] by making the benefits of the green economy inclusive and accessible to all individuals, families, and businesses.

3. To pursue investment strategies that advance market transformation in green investing while supporting the organization's pursuit of financial sustainability.

The vision statement, mission statement, and goals support the implementation of Connecticut's climate change, clean energy, and environmental infrastructure policies be they statutorily required (e.g., PA 21-53),[23] planning (e.g., Comprehensive Energy Strategy), or regulatory (e.g., Docket No. 17-12-03RE03)[24] in nature.

**Framework for an Equitable Modern Grid**[25]

The Public Utilities Regulatory Authority's ("PURA") Framework for an Equitable Modern Grid, seeks to (1) support, or remove barriers to, the growth of Connecticut's green economy; (2) enable a cost-effective, economy-wide transition to a decarbonized future; (3) enhance customer access to a more resilient, reliable and secure electricity commodity; and (4) advance the ongoing energy affordability dialogue in the state, particularly in underserved communities.

The Green Bank supports PURA in their efforts through participation in many of the re-openers in the equitable modern grid as a commentor, a participant and a program administrator.

## 2.4 Definitions – Clean Energy and Environmental Infrastructure

The Green Bank's investment focus is on "clean energy" and "environmental infrastructure" as defined by CGS Section 16-245n:

- **Clean Energy** – 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

[22] Per PA 20-05, "An Act Concerning Emergency Response by Electric Distribution Companies, the Regulation of Other Public Utilities and Nexus Provisions for Certain Disaster-Related or Emergency-Related Work Performed in the State," "vulnerable communities" means populations that may be disproportionately impacted by the effects of climate change, including, but not limited to, low and moderate income communities, environmental justice communities pursuant to section 22a-20a, communities eligible for community reinvestment pursuant to section 36a-30 and the Community Reinvestment Act of 1977, 12 USC 2901 et seq., as amended from time to time, populations with increased risk and limited means to adapt to the effects of climate change, or as further defined by DEEP in consultation with community representatives.

[23] An Act Concerning Energy Storage – https://www.cga.ct.gov/2021/act/Pa/pdf/2021PA-00053-R00SB-00952-PA.PDF

[24] Equitable Modern Grid Initiative – Electric Storage

[25] https://portal.ct.gov/PURA/Electric/Grid-Modernization/Grid-Modernization

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 GHG 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 CGS 16-1(a)(2).

- **Environmental Infrastructure** – structures, facilities, systems, services and improvement projects related to (A) water, (B) waste and recycling, (C) climate adaptation and resiliency, (D) agriculture, (E) land conservation, (F) parks and recreation, and (G) environmental markets, including, but not limited to carbon offsets[26] and ecosystem services.[27]

## 2.5 Governance

Pursuant to Section 16-245n of the CGS, the powers of the Green Bank are vested in and exercised by a Board of Directors ("BOD")[28] that is comprised of twelve voting and one non-voting members each with knowledge and expertise in matters related to the purpose of the organization – see Table 1.[29]

**Table 1. Board of Directors of the Connecticut Green Bank**

| Position | Status | Appointer | Voting |
|---|---|---|---|
| State Treasurer (or designee) | Ex Officio | Ex Officio | Yes |
| Commissioner of DEEP (or designee) | Ex Officio | Ex Officio | Yes |
| Commissioner of DECD (or designee) | Ex Officio | Ex Officio | Yes |
| Secretary of OPM (or designee) | Ex Officio | Ex Officio | Yes |
| Residential or Low-Income Group | Appointed | Speaker of the House | Yes |
| Investment Fund Management | Appointed | Minority Leader of the House | Yes |
| Environmental Organization | Appointed | President Pro Tempore of the Senate | Yes |
| Finance or Deployment of Renewable Energy | Appointed | Minority Leader of the Senate | Yes |
| Finance of Renewable Energy | Appointed | Governor | Yes |
| Finance of Renewable Energy | Appointed | Governor | Yes |
| Labor | Appointed | Governor | Yes |
| R&D or Manufacturing | Appointed | Governor | Yes |
| President of the Green Bank | Ex Officio | Ex Officio | No |

[26] Carbon offsets means an activity that compensates for the emission of carbon dioxide or other greenhouse gases by providing for an emission reduction elsewhere.

[27] Ecosystem services means benefits obtained from ecosystems, including, but not limited to, (A) provisioning services such as food and water, (B) regulating services such as floods, drought, land degradation and disease, and (C) supporting services such as soil formation and nutrient cycling.

[28] https://www.ctgreenbank.com/about-us/governance/board-of-directors/

[29] https://www.ctgreenbank.com/about-us/governance/

There are four (4) committees of the BOD of the Green Bank, including Audit, Compliance, and Governance Committee ("ACG Committee"), Budget, Operations, and Compensation Committee ("BOC Committee"), Deployment Committee, and the Joint Committee of the Energy Efficiency Board ("EEB") and the Green Bank.[30]

**Principal Statement of the Joint Committee**

To support the Joint Committee of the EEB and the Green Bank, the following is a principal statement to guide its activities:

The EEB and the Green Bank have a shared goal to implement state energy policy throughout all sectors and populations of Connecticut with continuous innovation towards greater leveraging of ratepayer funds and a uniformly positive customer experience.

The BOD of the Green Bank is governed through enabling legislation, as well as by an Ethics Statement and Ethical Conduct Policy, Resolutions of Purposes, Bylaws, Joint Committee Bylaws, and a Comprehensive Plan. All meetings, agendas, and materials of the Green Bank's BOD and its Committees are publicly available on the organization's website.[31,32]

## 2.6 Organizational Structure

The Green Bank is administered by a professional staff overseeing three (3) business units, including:

- **Incentive Programs** – the Governor and the CGA from time-to-time may decide that there are certain incentive programs that they seek to have the Green Bank administer (e.g., PA 21-53). The Green Bank administers such programs with the goal of delivering on the public policy objectives, while at the same time ensuring that funds invested by the Green Bank are cost recoverable.[33] For example, the Green Bank co-administers the Energy Storage Solutions ("ESS") program with the Electric Distribution Companies ("EDC") (i.e., Avangrid and Eversource Energy) to deploy 580 MW of behind the meter residential and non-residential battery storage systems through an upfront declining incentive block structure and ongoing performance-based incentive.

- **Financing Programs** – the Green Bank's core business is financing clean energy projects. The use of public revenues by the Green Bank (i.e., Clean Energy Fund ("CEF") and RGGI allowance proceeds) are to be invested with the expectation of

[30] Pursuant to CGS 16-245m(d)(2) – There shall be a joint committee of the Energy Conservation Management Board and the board of directors of the Connecticut Green Bank. The boards shall each appoint members to such joint committee. The joint committee shall examine opportunities to coordinate the programs and activities funded by the Clean Energy Fund pursuant to section 16-245n with the programs and activities contained in the plan developed under this subsection and to provide financing to increase the benefits of programs funded by the plan so as to reduce the long-term cost, environmental impacts and security risks of energy in the state. Such joint committee shall hold its first meeting on or before August 1, 2005.

[31] https://www.ctgreenbank.com/about-us/governance/board-meetings/ ~~https://www.ctgreenbank.com/about-us/governance/connecticut-grboard-meetings/~~

[32] https://www.ctgreenbank.com/about-us/governance/committee-meetings/ ~~https://www.ctgreenbank.com/about-us/governance/connecticut-grittee-meetings/~~

[33] In the past, per CGS 16-245ff, the Green Bank administered the Residential Solar Investment Program ("RSIP") which resulted in 350 MW of residential solar photovoltaic system deployment between 2012 through 2021.

principal and interest being paid back over time (i.e., earned revenues). For example, per CGS 16a-40g, the Green Bank administers the Commercial Property Assessed Clean Energy ("C-PACE") program. Through C-PACE, the Green Bank provides capital to building owners to make clean energy and resilience improvements on their properties that is paid back over time from a benefit assessment on the building owner's property tax bill. The interest earned from these types of investments, over time, is expected to cover the operational expenses and a return for the Green Bank.

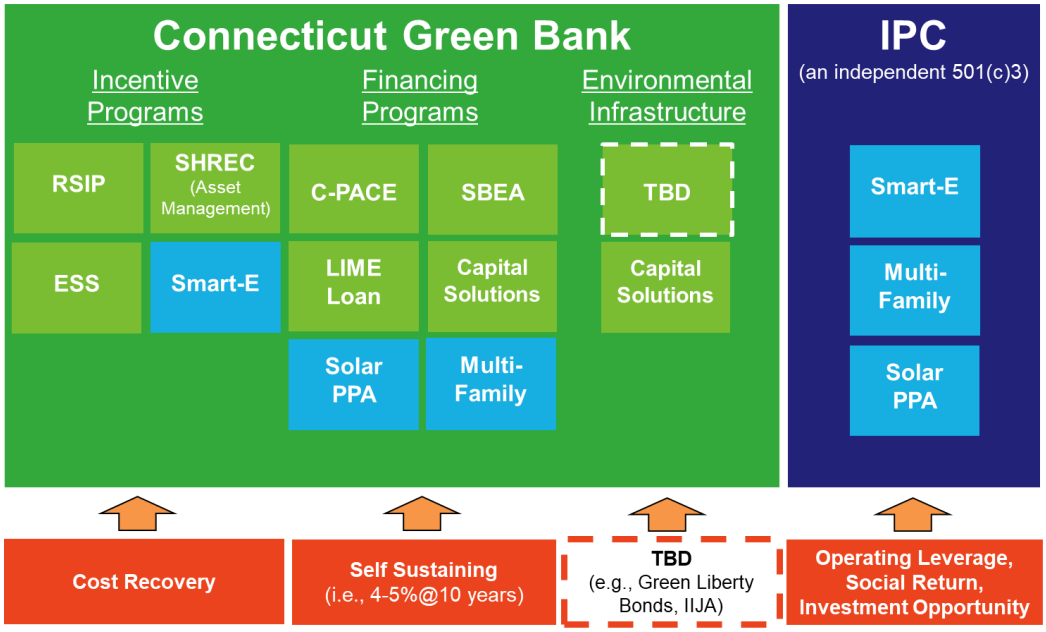
- **Environmental Infrastructure Programs** – as a result of the passage of PA 21-115 expanding the scope of the Green Bank beyond "clean energy" to include "environmental infrastructure," the financing tools of the green bank model will be used to mobilize private investment in Connecticut's green economy. Raising capital for the Environmental Infrastructure Fund ("EIF") through the issuance of Green Liberty Bonds, accessing federal resources (e.g., IIJA, GHGRF), and/or other means, will provide resources to invest in the modernization, decarbonization, and resilience of the state's environmental infrastructure.

These three business units – Incentive Programs, ~~and~~ Financing Programs (i.e., for "clean energy") and Environmental Infrastructure Programs – serve the purposes of the Green Bank. To support the business units and their investments, the Green Bank has administrative support from finance, legal, marketing and operations.

In FY19, the Green Bank, in partnership with DEEP and the Kresge Foundation, formed a nonprofit organization called Inclusive Prosperity Capital ("IPC"). The mission of IPC is to attract mission-oriented investors in underserved clean energy market segments (e.g., low-to moderate-income ("LMI") single and multifamily properties) of the green economy. Although not an affiliate, nor a component unit of the Green Bank, IPC serves an important role supporting Green Bank programs (e.g., Smart-E, Solar PPA, and Multifamily Affordable) through FY26.

For an overview of the organizational structure of the Green Bank, and its partnership with IPC – see Figure 1.

**Figure 1. Organizational Structure of the Green Bank with Support from Inclusive Prosperity Capital**




An Employee Handbook and Operating Procedures have been approved by the BOD and serve to guide the staff to ensure that it is following proper contracting, financial assistance, and other requirements.

# 3. Incentive Programs

The Green Bank administers incentive programs, including credit enhancements (e.g., interest rate buydowns, loan loss reserves), used to deploy clean energy and environmental infrastructure, while at the same time cost recovering the expenses associated with several of these programs (i.e., CGS 16-245ff, PA 21-53) within the business unit – including, but not limited to, incentives, administrative expenses, and financing costs.

## 3.1 Residential Solar Investment Program and Residential Renewable Energy Solutions

Residential Solar Investment Program

Per CGS 16-245ff, the Green Bank administered the Residential Solar Investment Program ("RSIP") to deploy no more than 350 megawatts of new residential solar PV systems on or before December 31, 2022, while promoting the sustained, orderly development of a local state-based solar PV industry and ensuring that solar PV systems are accessible and affordable to vulnerable communities.[34] As of ~~December 31~~June 30, 2022~~1~~, the RSIP achieved 3~~5~~50 MW of deployment, providing nearly~~over~~ 4~~7~~3,000 households with access to solar PV systems, including 50% within vulnerable communities. With the end of the RSIP policy on December 31, 2022, the focus of the Green Bank will be to manage the Solar Home Renewable Energy Credits ("SHREC") generated from the systems supported through the RSIP to recover

[34] Each year, from 2019 through 2021, and cumulatively from 2014 through 2021, Connecticut had the largest per capita deployment of residential solar PV in the entire northeast (i.e., New England, New Jersey, and New York) as a result of administering the RSIP (SEIA – Solar Market Insights 2022).

incentives, administrative expenses, and financing costs, by selling SHRECs to the EDCs through a 15-year Master Purchase Agreement ("MPA") to pay for bonds sold to support the program.

Residential Renewable Energy Solutions

Starting January 1, 2022, the residential solar PV market transitioned from the RSIP and net metering to a tariff-based compensation structure.[35] In order to ensure the continued sustained, orderly development of the local solar industry beyond the conclusion of the RSIP, and access to such clean energy technologies by vulnerable communities, the Green Bank actively engaged in the regulatory process (i.e., Docket No. 20-07-01) overseen by PURA to establish Residential Renewable Energy Solutions ("RRES") – an EDC-administered residential renewable energy tariff program.

As a result of the Green Bank's engagement in the PURA process for the RRES, the following key program design principles were included:

- **Rate of Return** – a just, reasonable, and adequate rate of return of between 9 to 11 percent was determined (i.e., equivalent to $0.294/kWh in 2021) for the 20-year tariff through the Green Bank's inclusion of an objective rate of return analysis of the RSIP;

- **HES or HES-IE Requirement** – to continue the linkage between energy efficiency and solar PV as demonstrated by the RSIP, an important objective of the Joint Committee, the Green Bank advocated for a Home Energy Solutions ("HES") or Home Energy Solutions – Income Eligible ("HES-IE") requirement as part of every project supported through RRES;

- **Additional Incentives for Vulnerable Communities** – given the success of the RSIP in reaching vulnerable communities, the Green Bank wanted to ensure that solar PV was affordable and accessible to LMI households, and thus adders for low income (i.e., $0.0250/kWh) or households located in distressed municipalities[36] (i.e., $0.0125/kWh) over the 20-year tariff were determined;

- **Direct Payment** – due to the perceived risks of underwriting financing (i.e., loans, leases, or power purchase agreements ("PPAs")) for vulnerable communities, the Green Back advocated for direct payments of the tariff rates from the EDCs to a third-party in-part or in-whole as a way to reduce borrower risk (including perceived risk) and therefore make renewable energy more affordable and accessible to vulnerable communities. This provides a financing mechanism that would allow the Green Bank to provide investment in developers serving vulnerable communities; and

- **Affordable Housing** – as part of the Green Bank-led amendments to Section 2 of PA 21-48,[37] which includes "affordable housing" as part of RRES (i.e., versus Non-Residential Renewable Energy Solutions or "NRES"), and a subsequent decision by PURA

[35] See CGS 16-244z and Docket No. 20-07-01

[36] https://portal.ct.gov/DECD/Content/About_DECD/Research-and-Publications/02_Review_Publications/Distressed-Municipalities

[37] An Act Establishing and Energy Efficiency Retrofit Grant Program for Affordable Housing – https://www.cga.ct.gov/2021/act/Pa/pdf/2021PA-00048-R00SB-00356-PA.PDF

in Docket No. 221-08-02, it will be easier for property owners to participate in RRES, enabling energy savings to both the property owner and its low-income tenants.

These key program design principles within the EDC-administered tariff program will improve the program's likelihood of success in deploying no less than fifty (50) megawatts of new residential solar PV a year, while ensuring that vulnerable communities have continued opportunities to reduce the burden of energy costs that they experienced through the RSIP. To support PURA in overseeing the EDC-administered RRES, the Green Bank is a consultant to the Office of Education, Outreach, and Enforcement.

## 3.2 Energy Storage Solutions

With the passage of PA 21-53 establishing a 1000 MW energy storage target by 2030, and the final decision in Docket No. 17-12-03RE03 on electric storage, the Green Bank was selected by PURA to co-administer a 580 MW behind the meter residential and non-residential battery storage incentive program with the EDCs called ESS. The Green Bank is responsible for administering the upfront incentive, marketing the program, overseeing evaluation, measurement, and verification ("EM&V"), and fostering the sustained, orderly development of a state-based electric energy storage industry. ESS seeks to deploy battery storage systems to help families and businesses become more resilient against power outages, while reducing peak demand during summer and winter periods reducing electric rates for all ratepayers.

## 3.3 EnergizeCT Smart-E Loan

The EnergizeCT Smart-E Loan ("Smart-E Loan") is a partnership between the Green Bank and local community banks and credit unions that provide easy and affordable access to capital for homeowners to finance clean energy and environmental infrastructure improvements on their properties through local contractors. The Green Bank provides credit enhancements to the participating financing institutions in the form of interest rate buydowns (i.e., from the use of federal resources) and loan loss reserves (i.e., from the Green Bank balance sheet). This allows financial institutions to provide low-interest and longer-term loans to families.

In FY 2023, the Green Bank, working with DEEP and other stakeholders, will be expanding the Smart-E Loan offering beyond clean energy to include environmental infrastructure measures.

## 3.4 Incentive Program Targets

The Green Bank has set targets for its Incentive Programs business unit for FY 2023 in terms of the number of projects, total investment (i.e., public and private), and installed capacity – see Table 2.

**Table 2. FY 2023 Targets for the Incentive Programs Business Unit**

| Program / Product | Projects | Total Investment ($MM's) | Installed Capacity (kW) |
|---|---|---|---|
| Energy Storage Solutions – Residential | 500 | $20.0 | 7,600 |

| | | | |
|---|---|---|---|
| Energy Storage Solutions – Non-Residential[38] | 0 | 0 | 0 |
| EnergizeCT Smart-E Loan | 960 | $15.0 | 200 |
| **Total** | **1,460** | **$35.0** | **7.8** |

In terms of the Green Bank's vulnerable community's prioritization, the following is a goal for Incentive Programs:

- By 2025, no less than 40 percent of investment and benefits (e.g., jobs) from Incentive Programs is directed to vulnerable communities.

As a result of successfully achieving these targets, the Green Bank will reduce energy burden and increase energy security for Connecticut families and businesses, especially those in vulnerable communities, create jobs in our communities, raise tax revenues for the State of Connecticut, and reduce air pollution causing local public health problems and contributing to global climate change.

# 4. Financing Programs

The Green Bank manages financing programs. That is to say that it oversees financing programs that invest capital upfront (i.e., public revenues including CEF and RGGI) to deploy clean energy, while at the same time returning principal and interest (i.e., earned revenues) over time from the financing of projects, products, or programs to ensure the financial sustainability of the Green Bank.

## 4.1 Commercial Property Assessed Clean Energy

Per CGS 16a-40g, C-PACE enables building owners to pay for clean energy improvements over time through a voluntary benefit assessment placed by participating municipalities on their property tax bills. As of June 30, 2022, there have been 139 cities and towns that have opted into C-PACE. This process makes it easier for building owners to secure low-interest capital for up to 25 years to fund clean energy improvements and is structured so that energy savings more than offset the benefit assessment. With the passage of PA 22-6,[39] resilience and electric vehicle recharging stations were added to the list of eligible measures for C-PACE.

In FY 2023, the Green Bank, working with DEEP, Connecticut Institute for Resilience and Climate Adaptation ("CIRCA"), and other stakeholders, will be expanding C-PACE beyond clean energy to include resilience[40] measures.

## 4.2 Green Bank Solar Power Purchase Agreement & Solar Roof Lease

The Green Bank Solar PPA and the Green Bank Solar Roof Lease are third-party ownership structures to deploy solar PV systems for commercial scale end-use customers (e.g.,

[38] It should be noted that as of June 30, 2022, that 39 non-residential battery storage projects were submitted for approval totaling 64.3 MW and an estimated $90.4 MM of investment. Of those projects, 4 have been approved totaling 3.8 MW and received a Reservation of Funds letter. All of these projects must work through the interconnection process of the EDCs, which could take months, if not years to review and approve.

[39] An Act Concerning the Commercial Property Assessed Clean Energy Program – https://www.cga.ct.gov/2022/act/Pa/pdf/2022PA-00006-R00SB-00093-PA.PDF

[40] Per CGS 16-244aa, "resilience" means the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from deliberate attacks, accidents or naturally occurring threats or incidents, including, but not limited to, threats or incidents associated with the impacts of climate change.

businesses, nonprofits, municipal and state governments, affordable multifamily properties, etc.) that uses a multi-year PPAs or site lease to finance projects while either reducing energy costs for the host customer or providing a fixed annual lease payment.

## 4.3 Small Business Energy Advantage & Business Energy Advantage

Small Business Energy Advantage ("SBEA") and Business Energy Advantage ("BEA") are Eversource Energy administered on-bill commercial energy efficiency financing programs for small and medium-sized businesses, municipalities and Connecticut state agencies. Low-cost capital is provided by Amalgamated Bank with a credit enhancement from the Green Bank (i.e., subordinated debt) and the Connecticut Energy Efficiency Fund (i.e., loan loss guaranty and interest rate buydown). SBEA and BEA enables qualifying customers to access 0% on bill financing for up to $100,000 per site for businesses (up to a maximum of $1,000,000), up to $5,000,000 for municipalities, and up to $5,000,000 per project for state facilities with no overall outstanding loan cap.

## 4.4 Multifamily Products

Defined as buildings with 5 or more units, the Green Bank provides a suite of financing options in collaboration with our partners IPC and Capital for Change (a Community Development Financial Institution or "CDFI") that support property owners to assess, design, fund, and monitor high impact clean energy and health & safety improvements for their properties.

## 4.5 Green Bank Capital Solutions

As opportunities present themselves, the Green Bank from time-to-time invests as part of a capital structure in various projects (e.g., fuel cell, hydropower, food and farm waste to energy). These projects are selected based on the opportunity to expand the organization's experience with specific technologies, advance economic development in a specific locale, or to drive adoption of clean energy that would otherwise not occur, while also earning a rate of return.

## 4.6 Financing Program Targets

The Green Bank has set targets for its Financing Programs business unit for FY 2023 in terms of the number of projects, total investment (i.e., public and private), and installed capacity – see Table 3.

**Table 3. FY 2023 Targets for the Financing Programs Business Unit**

| Program / Product | Projects | Total Investment ($MM's) | Installed Capacity (kW) |
|---|---|---|---|
| Commercial PACE | 23 | $31.0 | - |
| Green Bank Solar PPA | 19 | $13.7 | 7,600 |
| Small Business Energy Advantage | 839 | $18.6 | - |
| Multifamily Term Loan | 6 | $1.4 | 600 |
| Multifamily Health and Safety | 1 | $0.9 | - |
| Strategic Investments | 2 | $7.5 | - |
| **Total** | **882** | **$64.2** | **7,600** |

In terms of the Green Bank's vulnerable communities prioritization, the following is a goal for Financing Programs:

- By 2025, no less than 40 percent of investment and benefits (e.g., jobs) from Financing Programs is directed to vulnerable communities.

The capital provided by the Green Bank, which is a portion of the total investment, is expected to yield a return commensurate with the financial sustainability objectives of the organization and business unit.

As a result of successfully achieving these targets, the Green Bank will contribute to its financial sustainability, while also reducing the energy burden on and improve the resiliency from climate change for Connecticut families and businesses, especially those in vulnerable communities, create jobs in our communities, raise tax revenues for the State of Connecticut, and reduce air pollution that cause local public health problems and global climate change.

## 5. Environmental Infrastructure Programs

Following the passage of PA 21-115 in June of 2021, the Green Bank began the process of policy assessment and development for environmental infrastructure in FY 2022, including:

- **Governance Amendments** – revising various governance documents including the Resolution of Purpose, Bylaws, and Operating Procedures;

- **Assessing Bond Potential** – investigating the potential for Green Liberty Bonds to be issued to raise proceeds for environmental infrastructure investment, including fifty (50) year maturity terms;

- **Developing Products** – expanding the ability for the Smart-E Loan to support environmental infrastructure projects for single family property owners and C-PACE to support resilience projects for multifamily and commercial property owners;

- **Stakeholder Engagement** – initiating outreach to public, private, nonprofit, and academic stakeholder organizations to introduce the Green Bank, understand public policies and targets, identify funding opportunities, market potential, investment requirements, and financing models, and metrics for environmental infrastructure; and

- **Strategic Retreat** – engaging members of the BOD, staff, and key stakeholders in an offsite strategic retreat to expand the scope of the Green Bank to mobilize private investment in environmental infrastructure.

As a result of these efforts in FY 2022, the Green Bank makes the following observations with respect to environmental infrastructure:

1. **Market Intermediary Role** – as is the case with respect to "clean energy," the Green Bank has a role to play as a market intermediary for "environmental infrastructure" – see Figure 2. Given the ambitious nature of public policies with respect to environmental infrastructure (e.g., 21% open space by 2023), and the need to mobilize and attract private investment to achieve the policy objectives (e.g., $1.5 billion of

additional public and/or private investment needed to achieve the open space target), there is a need for an intermediary role for the Green Bank between capital markets and public policy.

**Figure 2. Market Intermediary Role - Capital Markets and Public Policy**


2. **<u>Better Market Signals</u>** – again, as is the case with respect to "clean energy" (e.g., zero emission renewable energy credits), there is a need for public policy to send better market signals to unlock and mobilize private capital investment in "environmental infrastructure". For example, beyond "sticks" (e.g., regulation and enforcement requiring producers of food waste to transport their waste to an anaerobic digester per PA 11-127), there need to also be associated "carrots" (e.g., virtual net metering, low emission renewable energy credits, renewable natural gas) in order to enable private investment in "environmental infrastructure". A strong market signal public policy for green and blue infrastructure is Maryland's Conservation Finance Act of 2022 and the pay-for-success contracts for certain environmental outcomes.[41]

3. **<u>Appropriately Priced Capital</u>** – if public policy in Connecticut is designed to reduce risks (including perceived risks), then attracting and mobilizing appropriately priced private capital (e.g., lower interest rates, longer terms) must ensue. The Green Bank can access affordable private capital through the issuance of Green Liberty Bonds, which can be paid back over 50 years (or the useful life of the asset) and whose proceeds can be invested in environmental infrastructure.

4. **<u>Community Engagement</u>** – there is a continuous need to not only engage public, private, nonprofit and academic stakeholders, but also municipal, councils of government, and other community-level officials. Empowering impacted communities, especially vulnerable communities, through near-term engagement (i.e., informing, consulting, and involving) to long-term engagement (i.e., collaborating and empowering) is vital to identifying needs to support the development of programs and the success of investments in projects to achieve their intended impacts.

[41] https://mgaleg.maryland.gov/mgawebsite/Legislation/Details/sb0348?ys=2022RS ~~https://mgaleg.maryland.gov/mgawebsite/Legislation/Details/SB0348~~

5. **Vulnerable Communities** – with a key goal to "strengthen Connecticut's communities, especially vulnerable communities, by making the benefits of the green economy inclusive and accessible to all individuals, families, and businesses," as is the goal for "clean energy," the Green Bank will ensure that by the end of 2025 no less than 40 percent of investment and benefits (e.g., jobs) in "environmental infrastructure" are directed to vulnerable communities.

In FY 2023, the Green Bank will continue its progress on developing its environmental infrastructure business unit and programs including, but not limited to:

- **Building the Team** – hiring several critical positions including the Manager of Community Engagement and Director of Environmental Infrastructure, as well as qualifying a suite of contractors to support the work of the business unit;

- **Continuing Engagement** – wrapping up stakeholder outreach for the water ~~, waste and recycling sectors,~~ and initiating engagement of municipal and regional governments, especially those in vulnerable communities;

- **Raising Resources** – identifying and realizing opportunities for federal (i.e., GHGRF) and foundation funding, and developing the Green Liberty Bonds to raise proceeds from the issuance of bonds to provide capital for investment;

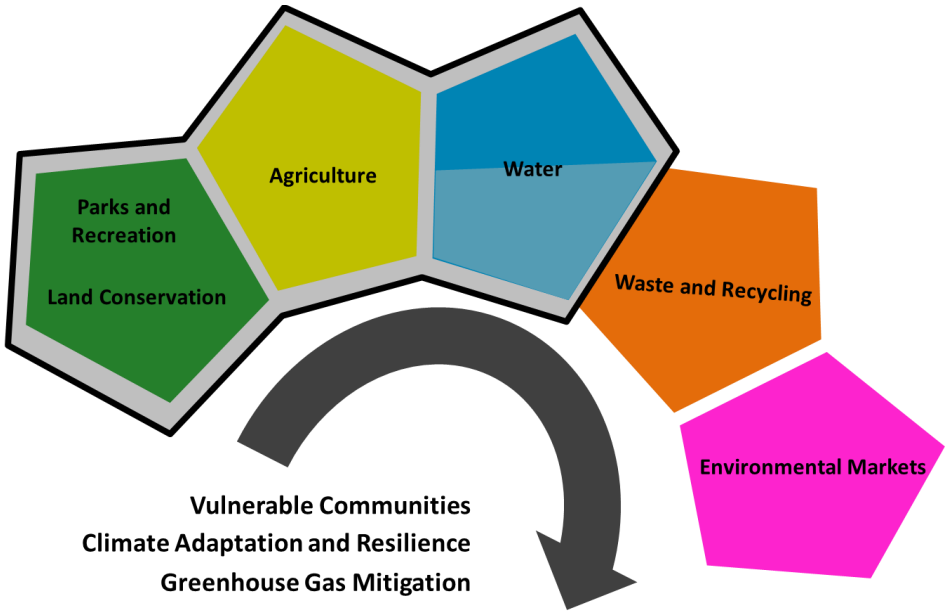
- **Launching New Products** – developing existing financing products for clean energy (i.e., Smart-E Loan, C-PACE) to support environmental infrastructure measures; and

- **Conducting Research** – continuing to identify research opportunities to develop markets for carbon offsets and ecosystem services for the purposes of generating revenues from projects as a result of Green Bank investments.

## 5.1 Confronting Climate Change and Vulnerable Communities

Given the mission of the Green Bank, investments in environmental infrastructure must seek to confront climate change (i.e., mitigate GHG emissions and increase resilience against its impacts) and increase investment in vulnerable communities – see Figure 3. The combination of land conservation, parks and recreation, agriculture, and water – together "green infrastructure" or "nature-based solutions" – provide an opportunity for the Green Bank, in partnership with public, private, nonprofit, municipal and other stakeholders, to mobilize investment.

**Figure 3. Confronting Climate Change and Enabling Investment in Vulnerable Communities through Environmental Infrastructure**




Through stakeholder engagement, the Green Bank recognizes the opportunity for investment in nature-based solutions that protect land and water from loss, improve management of natural resources for productive use in the economy, and restore native cover – all of which help Connecticut confront climate change – see Figure 4.

**Figure 4. Nature-Based Solutions and Green Infrastructure**


In terms of the Green Bank's vulnerable communities prioritization, the following is a goal for Environmental Infrastructure Programs:

- By 2025, no less than 40 percent of investment and benefits (e.g., jobs) from Environmental Infrastructure Programs is directed to vulnerable communities.

The following is a succinct breakdown of each area of environmental infrastructure, including links to more detailed primers based on stakeholder outreach.

## 5.2 Environmental Markets – Carbon Offsets and Ecosystem Services

Carbon offsets are measurable outcomes from carbon sequestration activities, traded in voluntary (e.g., requiring verification and certification) and compliance (e.g., RGGI) markets,

whereby regulations, sustainability priorities, and public relations are motivators for buyers and sellers. Ecosystem services are the benefits people obtain from ecosystems.[42] Fundamentally, ecosystem services markets are designed to embed the positive benefits (e.g., public health, resilience) and negative impacts (e.g., GHG emissions) of individuals on natural resources into market-based systems which financially incentivize environmental stewardship, conservation, and rehabilitation of natural ecosystems.

Environmental infrastructure projects that involve carbon offsets and ecosystem services can be quantified and sold in markets to generate additional revenues from the projects.

For further details on the market opportunity, see Primer – Environmental Markets.

## 5.3 Land Conservation

Nature-based solutions such as protecting intact lands from loss (e.g., forestlands, wetlands), improving the management of working lands (e.g., sustainably certified timberlands), and restoring native land cover, including coastlines, can both mitigate GHG emissions that cause climate change (e.g., forest carbon sequestration) and increase resilience against the impacts of climate change (e.g., flood protection).

The following is the market potential for land conservation from the perspective of forestland – see Table 4.

**Table 4. Market Potential for Land Conservation in Connecticut based on Forest Land**

| **3,205,762 Acres Land in Connecticut** | | | | |
|---|---|---|---|---|
| **1,869,761 Acres** Forest Land | | | **1,336,001 Acres** Non-Forest Land | |
| **298,994 Acres** Protected Core Forests | **568,857 Acres** Unprotected Core Forest | **1,001,910 Acres** Non-Core Forest | **1,130,000 Acres** Urban Area | **206,001 Acres** Other Non-Urban and Non-Forest |

To retain the multiple benefits that forests provide, there is a "no net loss of forest" policy goal.

The following is a breakdown of the land conservation target outlined in the CGS 23-8[43] – see Table 5.

**Table 5. Progress Towards the Open Space Land Target in Connecticut (as of December 31, 2019)**

| **3,205,762 Acres Land in Connecticut** | | |
|---|---|---|
| **320,576 Acres** | **352,634 Acres** | **2,532,552 Acres** |

[42] Provisioning services (e.g., food, water, fuel, wood), supporting services (e.g., nutrient cycling, soil formation, habitat provision, primary production), regulating services (e.g., climate regulation, flood regulation, water purification), and cultural (e.g., spiritual, aesthetic, educational, and recreational).

[43] State goal for open space acquisition – https://law.justia.com/codes/connecticut/2012/title-23/chapter-447/section-23-8/

| State Goal (@10%) | | | | Partner Goal (@≥11%) | | | | No Land Conservation (@79%) |
|---|---|---|---|---|---|---|---|---|
| **175,000 Acres** State Forests[44] | **36,000 Acres** State Parks[45] | **46,000 Acres** Wildlife Area and Other[46] | **63,500 Acres** left to achieve target | **84,000 Acres** Cities and Towns | **99,000 Acres** Water Companies | **66,000 Acres** Non-Profit Land Trusts | **104,000 Acres** left to achieve target | |

Of the open space goal of 21% by 2023 (i.e., 673,210 acres), approximately 510,249 acres are conserved (as of December 31, 2019), or 76% of the open space goal comprising 261,806 acres of state (i.e., 82% of the 10% state target) and 248,953 acres of partner (i.e., 71% of the partner target) – leaving an estimated 162,451 acres of open space left to achieve. If the average land acquisition cost is $9,000 per acre, then approximately $1.5 billion of public and private investment in land conservation would be needed to acquire and protect over 160,000 acres of open space in order to achieve the 21% target.

As the Green Bank looks to increase and accelerate private investment in land conservation, it will be exploring the following financing tools, including, but not limited to:

- Carbon offset markets
- Ecosystem services markets
- Pay-for-Performance
- Eco-Labeling (e.g., FSC Certified)
- Green Liberty Bonds
- Buy-Protect-Sell Revolving Loan Fund
  - Predevelopment Financing
  - Bridge Financing
  - Traditional Debt Financing
- Forest Investment Fund

For further details on the market opportunity, see Primer – Land Conservation.[47]

## 5.4 Parks and Recreation

Infrastructure investments in parks and recreation can both mitigate the GHG emissions that cause climate change (e.g., carbon sinks from urban tree canopy cover) and increase resilience against the impacts of climate change (e.g., stormwater management through urban parks, improve public health).

The following is a breakdown of the market potential for parks and recreation from the perspective of active[48] and passive[49] outdoor recreation facilities, and on "land" or "water"

[44] 33 locations

[45] 107 locations

[46] Including wildlife management areas, fish hatcheries, flood control, natural area preserve, water access, wildlife sanctuaries, and other

[47] https://www.ctgreenbank.com/wp-content/uploads/2023/01/Environmental-Infrastructure_Land-Conservation_Oct-16-2022.pdf

[48] Active outdoor recreation facilities based on 2005 data (X – #) and 2017 use frequency index data, if available (# – Y), include fields, courts, and courses for baseball and softball (984 – 16.0), basketball (645 – 23.0), football (154 – 10.0), golf (125 – 13.6), multi-use (624), soccer (495 – 14.6), tennis (384 – 11.2), and volleyball (74 – 23.0), as well as playgrounds (1,065), swimming pools (137 – 60.9), and winter sports (238 – 9.3)

[49] Passive outdoor recreation facilities based on 2005 data (X – #) and 2017 use frequency index data, if available (# – Y) include access to sites for beaches (176 – 60.1), boating (285 – 10.9), camping (88 – 13.5), fishing (669 – 19.0), gardens (109), historic landmarks (99 – 35.9), hunting (88 – 3.5), picnics (677), and trails (896 – 102.8)

based activities from the Statewide Comprehensive Outdoor Recreation Plan ("SCORP") – see Table 6.

**Table 6. Outdoor Recreation Facilities in Connecticut (2005)**

| Outdoor Recreation Type | # of Facilities | DIRPS[50] per 10,000 Residents | Ownership | | |
|---|---|---|---|---|---|
| | | | Statewide Average | Municipal Average | Other Average |
| **Active – Land** | 4,788 | 1.4 | 4% | 77% | 20% |
| **Active – Water** | 137 | 0.4 | 2% | 69% | 30% |
| **Passive – Land** | 1,957 | 1.0 | 27% | 46% | 27% |
| **Passive – Water** | 1,130 | 1.1 | 22% | 45% | 33% |
| **Total** | 8,012 | 1.2 | 14% | 62% | 24% |

The Trust for Public Land's ("TPL") ParkScore Index is a comprehensive rating system to measure how cities are meeting the needs for parks.[51] In an effort to assess ParkScore, the following data are for Connecticut's "Top 10" most populated municipalities with respect to park access – see Table 7.

**Table 7. "Top 10" Most Populated Municipalities in Connecticut and ParkScore**

| City | Population | Acres | % Land as Parks | Acres of Land as Parks | Acres of Parks per 10,000 Residents | # of Parks | Parks per 10,000 Residents | 10-Minute Walk |
|---|---|---|---|---|---|---|---|---|
| **Hartford** | 121,203 | 11,136 | 9% | 1,002 | 83 | 218 | 18.0 | 99% |
| **New Haven** | 130,764 | 11,968 | 12% | 1,436 | 110 | 128 | 9.8 | 96% |
| **West Hartford** | 63,063 | 13,952 | 20% | 2,790 | 442 | 48 | 7.6 | 82% |
| **Stamford** | 129,302 | 24,064 | 5% | 1,203 | 93 | 54 | 4.2 | 74% |
| **New Britain** | 72,303 | 8,576 | 7% | 600 | 83 | 23 | 3.2 | 73% |
| **Bridgeport** | 143,653 | 10,304 | 7% | 721 | 50 | 35 | 2.4 | 73% |
| **Waterbury** | 106,458 | 18,240 | 6% | 1,094 | 103 | 30 | 2.8 | 60% |
| **Norwalk** | 88,326 | 14,656 | 3% | 440 | 50 | 45 | 5.1 | 55% |
| **Bristol** | 59,639 | 16,896 | 4% | 676 | 113 | 20 | 3.4 | 51% |
| **Danbury** | 84,732 | 26,880 | 5% | 1,344 | 159 | 17 | 2.0 | 37% |

The quality of parks is difficult to discern. To better understand the quality of parks, TPL partnered with the Urban Resources Institute ("URI") to compare New Haven against the

[50] Discrete Identifiable Recreation Places

[51] The "% of Land as Parks," "# of Parks," and "10-Minute Walk" data were used from TPL's ParkScore data set.

nation's most populous cities on five (5) categories reflective of an excellent city park system: Acreage,[52] Access,[53] Investment,[54] Amenities,[55] and Equity[56] – see Table 8.[57]

**Table 8. TPL and URI Analysis of New Haven Compared to Other Cities**

| City | Overall | Acreage | Access | Investment | Amenities | Equity |
|---|---|---|---|---|---|---|
| **New Haven, CT** | 60 | 36 | 95 | 35 | 71 | 65 |
| **Boston, MA** | - | 47 | 100 | 79 | 65 | 79 |
| **Baltimore, MD** | - | 25 | 81 | 68 | 40 | 83 |
| **Buffalo, NY** | - | 25 | 85 | 47 | 61 | 64 |

The TPL-URI research also delves deeper into the twenty (20) neighborhoods of New Haven to collect data with respect to population, acres of parks, and acres per 1,000 population, as well as demographic data including income and people of color. Based on data from TPL from 14,000 cities, parks that serve low-income households are four (4) times as crowded as parks that serve high-income households, and parks that serve people of color are five (5) times as crowded as parks that serve majority-white populations.[58] Such analyses in municipalities across Connecticut could elucidate opportunities for areas of improvement, including improving the public health of residents (e.g., reducing urban heat island effects) with access to parks and the economic development impact of property values within proximity to parks.

As the Green Bank looks to increase and accelerate private investment in parks and recreation, it will be exploring the following financing tools, including, but not limited to:

- Carbon offset markets
- Ecosystem services markets (e.g., Park Rx)
- Pay-for-Performance
- Green Liberty Bonds
- Tax Increment Financing
- Buy-Protect-Sell Revolving Loan Fund
  - Predevelopment Financing
  - Bridge Financing
  - Traditional Debt Financing

For further details on the market opportunity, see Primer – Parks and Recreation.[59]

[52] Acreage score indicates the relative abundance of large 'destination' parks, which include large natural areas that provide critical mental health as well as climate and conservation benefits.

[53] Access score indicates the percentage of the city's residents that live within a walkable half-mile of a park – the average distance that most people are willing to walk to reach a destination.

[54] Investment score indicates the relative financial health of a city's park system, which is essential to ensuring parks are maintained at a high level for all to enjoy.

[55] Amenities score indicates the relative abundance of six park activities popular among a multi-generational cross-section of user groups (i.e., playgrounds, basketball courts, dog parks, senior and recreation center, splashpads, and permanent restrooms).

[56] Equity score indicates how fairly parks and park space are distributed within a city, including percentage of people of color and low-income households within a 10-minute walk of a park, and comparison of the amount of park space between neighborhoods by race and income.

[57] For example, a score of 90 means that the municipality is within the top 90 percent across the country.

[58] "The Heat is On" by The Trust for Public Lands

[59] https://www.ctgreenbank.com/wp-content/uploads/2023/01/Environmental-Infrastructure_Parks-and-Recreation_Oct-16-2022.pdf

## 5.5 Agriculture

Nature-based solutions such as protecting farmlands from loss and improving farming practices, can both mitigate GHG emissions that cause climate change (e.g., climate smart agriculture) and increase resilience against the impacts of climate change (e.g., flood protection).

The following is a breakdown of the market potential for "agriculture" (i.e., farmland), including other natural forms of land cover (i.e., forestland and wetlands) – see Table 9.

**Table 9. Land Cover in Connecticut (2015)**[60]

| **3,179,253 Acres Land and Water in Connecticut** | | | | |
|---|---|---|---|---|
| **921,827 Acres** Developed Land[61] 29% | **233,847 Acres** Farmland 7% | **1,873,471 Acres** Forestland[62] 59% | **129,153 Acres** Wetlands[63] 4% | **20,955 Acres** Other Lands[64] 1% |

More than 70% of Connecticut's land is farmland, forestland, or wetland. From 2001 through 2016, approximately 6% of the state's farmland was converted to urban or low-density residential development – placing the state in the top three nationally in percent of farmland lost to development.[65]

The long-term goal of the Farmland Preservation Program, which was set back in the 1980's, is to preserve 130,000 acres of farmland – see Table 10.

**Table 10. Progress Towards the Farmland Preservation Program Target in Connecticut**

| **3,205,762 Acres Land in Connecticut** | | | | |
|---|---|---|---|---|
| **381,539 Acres**[66] Farmland | | | | **2,824,223 Acres** Non-Farmland |
| **148,609 Acres** Farmland | **113,355 Acres** Woodland | **31,923 Acres** Pastureland | **87,652 Acres** Other[67] | |
| **130,000 Acres Preserved Farmland Goal** | | | | |
| **48,744 Acres** Preserved | **81,256 Acres** Not Preserved | | | |

[60] UCONN CLEAR Project – 2015 Land Cover
[61] Includes "Developed," "Turf & Grass," and "Other Grasses" classifications
[62] Includes "Deciduous Forest," "Coniferous Forest," "Forested Wetland," and "Utility-Rights-of-Way (Forest)" classifications
[63] Includes "Water," "Non-Forested Wetlands," and "Tidal Wetlands" classifications
[64] Includes "Barren" classification
[65] "Planning for Agriculture – A Guide for Connecticut Municipalities: Emerging Agricultural Trends" by the American Farmland Trust and Connecticut Department of Agriculture (2020 Edition) (Page 19)
[66] USDA Economic Research Service – 2017 data
[67] Land in house lots, ponds, roads, wasteland, etc.

As of October 2020, the Farmland Preservation Program has protected nearly 49,000 acres on 418 farms with agricultural conservation easements – leaving 81,000 acres of farmland left to preserve.[68] If the average real estate value of an acre of farmland in Connecticut in 2019 was $12,200, and Purchasing Development Rights ("PDR") is 30-50% of value, then between $300 to $500 MM of public investment (e.g., through the Connecticut Department of Agriculture ("DoAg") and/or USDA-Natural Resources Conservation Service ("NRCS")) would be needed to protect 81,000 acres of farmland to achieve the 130,000 acres of farmland preserved target.

As the Green Bank looks to increase and accelerate private investment in agriculture, it will be exploring the following financing tools, including, but not limited to:

- Carbon offset markets
- Ecosystem services markets
- Pay-for-Performance
- Eco-Labeling (e.g., Connecticut Grown)
- Green Liberty Bonds
- Linked Deposits
- Buy-Protect-Sell Revolving Loan Fund
  - Predevelopment Financing
  - Bridge Financing
  - Traditional Debt Financing
- Farmland Investment Fund
- Loan Guarantees (e.g., Smart-E Loan)

For further details on the market opportunity, see Primer – Agriculture.[69]

## 5.6 Water

In FY 2023, the Green Bank will continue to explore opportunities to enable private investment in Connecticut's water infrastructure.

Per PA 21-115, there are several boundaries with respect to what the Green Bank can do with respect to water, including:

- **Environmental Infrastructure Fund** – may not receive funds from the Clean Water Fund pursuant to sections 22a-475 to 22a-438f, or funds collected from a water company as defined in section 25-32a; and

- **Apply for Federal Assistance** – may not apply directly or through a subsidiary to be eligible for federal grant assistance under the Clean Water Act, 33 USC 1251 et seq., nor the Safe Drinking Water Act, 42 USC 300f et seq., without the approval of the State Treasurer, Commissioner of Energy and Environmental Protection, and Commissioner of Public Health.

As a result of these restrictions, and since Connecticut's State Revolving Fund ("SRF") hasn't invested in green infrastructure,[70] the Green Bank will focus its efforts on nature-based solutions (e.g., land conservation) and stormwater (e.g., green roofs), as well as its financing programs (e.g., Smart-E Loan, C-PACE) to help end-use customers improve water on their property. It should be noted that within PA 21-115, that municipalities can create stormwater authorities.

[68] Connecticut Department of Agriculture, Farmland Preservation Programs Report (January 2022)
[69] https://www.ctgreenbank.com/wp-content/uploads/2023/01/Environmental-Infrastructure_Agriculture_Oct-16-2022a.pdf
[70] Hansen, K., Thomas, T., Vo, S., Berven, K., Moudgalya, P., Vedachalam, S. (2022). Financing Green Stormwater and Natural Infrastructure with Clean Water State Revolving Funds. by the Environmental Policy Innovation Center – EPIC. (pp 11)

## 5.7 Waste and Recycling

In FY ~~2023~~2024, the Green Bank will explore opportunities to enable private investment in Connecticut's waste and recycling infrastructure.

It should be noted that the Green Bank is a leading financier of food waste[71] and farm waste[72] to energy projects that utilize anaerobic digesters and combined heat and power to reduce methane and produce renewable natural gas for onsite clean energy.

# 6. Citizen and Community Engagement – Green Bonds US

The Green Bank, and its predecessor the CCEF, have a long-standing history of community engagement in Connecticut. In 2002, the CCEF partnered with six private foundations[73] to co-found SmartPower – which launched the 20 percent by 2010 campaign and led the administration of the CCEF's EPA award-winning Connecticut Clean Energy Communities Program to engage citizens in signing-up to purchase clean energy.[74] Then in 2013, the Green Bank launched a series of Solarize campaigns in communities across the state in partnership with SmartPower and the Yale Center for Business and the Environment to help citizens install solar PV on their homes,[75] while also advancing the SunShot Initiative of the U.S. Department of Energy ("USDOE") in partnership with the Clean Energy States Alliance through projects that reduce soft-costs for solar PV (i.e., customer acquisition, permitting, and financing) and provide better access to solar PV for LMI households.

Citizen and community engagement have been in the DNA of the Green Bank since its inception. The Green Bank is reaching citizens and communities through various ways including green bonds, community match funds, community-based campaigns, and municipal assistance programs.

## 6.1 Green Bonds US

Whether through markets or within communities, the Green Bank is bringing people together and strengthening the bonds we share with one another. As the name of the Comprehensive Plan suggests – "Green Bonds US" seeks to promote a simple but critically important message; green, the environment, bonds us, brings us together, the environment unites us. The simple slogan combines the financial tool of green bonds that are being sold to retail investors across the United States with a unifying message that humanity and the environment are inextricably linked.

CGS Section 16-245n(d)(1)(C) is the enabling statute that allows the Green Bank to issue revenue bonds for up to 25 years for clean energy and 50 years for environmental infrastructure projects to support its purposes. Green Bonds are bonds whose proceeds are

[71] Quantum Biopower – http://www.quantumbiopower.com/

[72] Fort Hill Farm – https://aggridenergy.com/fort-hill-ag-grid-digester/

[73] Emily Hall Tremaine Foundation, The John Merck Fund, Pew Charitable Trust, The Oak Foundation, Rockefeller Brothers Fund, and Surdna Foundation

[74] "Climate Policy and Voluntary Initiatives: An Evaluation of the Connecticut Clean Energy Communities Program," by Matthew Kotchen for the National Bureau of Economic Research (Working Paper 16117).

[75] "Solarize Your Community: An Evidence-Based Guide for Accelerating the Adoption of Residential Solar" by the Yale Center for Business and the Environment.

used for projects or activities with environmental or climate benefits, most usually climate change mitigation and adaptation. Research shows that citizens across the US, including Connecticut, are interested in seeing their investments go towards green projects – see Table 11.[76]

**Table 11. Green Project Types of Interest by Private Investors by Location**

| Green Project Types | Composite | National | Connecticut | Connecticut with Solar |
|---|---|---|---|---|
| Clean Water | 65.4% | 63.5% | 68.6% | 65.8% |
| Waste Reduction and Recycling | 48.8% | 40.7% | 51.4% | 62.2% |
| Rooftop Solar | 48.5% | 34.9% | 38.4% | 85.6% |
| Home Energy Efficiency | 41.6% | 30.7% | 37.2% | 67.6% |
| Electric Vehicles | 38.0% | 30.9% | 30.0% | 60.2% |
| Land Conservation | 37.3% | 29.5% | 40.4% | 49.4% |
| Agriculture | 33.2% | 26.1% | 36.6% | 43.8% |
| Parks and Recreation | 30.1% | 24.8% | 34.6% | 36.0% |
| Climate Adaptation and Resiliency | 28.8% | 21.8% | 30.4% | 41.0% |

To enable everyday citizens with an opportunity to invest in the green economy, the Green Bank created two fixed income securities – Green Liberty Bonds and Green Liberty Notes, which have three features:

1. **Use of Proceeds** – funds raised from the bonds must go towards projects that support the Paris Agreement (i.e., mitigation of GHG emissions or adaptation to the impacts of climate change);

2. **Retail Accessible** – like the Series-E War Bonds of the 1940's, bonds must be small denomination (i.e., less than $1,000) and available to everyday retail investors; and

3. **Independently Certified and Verified** – due to the expectation by retail investors that the use of proceeds will go towards projects that support the Paris Agreement, the bonds must be independently certified and verified as green.

## 6.2 Green Liberty Bonds

In April of 2019, the Green Bank issued $38.6 million in green asset backed securities – its first rated debt issuance and the first ever solar asset-backed security ("ABS") transaction by a green bank. The issuance was certified by Kestrel Verifiers and independently assessed by Climate Action Reserve. In July 2020, the Green Bank issued $16.8 million in a Special Capital Reserve Fund ("SCRF") backed Green Liberty Bond that was Climate Bond Certified. And in April 2021, the Green Bank sold out $25 million in Green Liberty Bonds drawing four times as much demand as could be fulfilled from retail investors in Connecticut and across the U.S., as well as institutional investors interested in sustainability investments.

[76] 2021 Brand Awareness Digital Survey by Great Blue for the Connecticut Green Bank (August 2021)

In March and December of 2020, and June of 2022, the Green Bank's Green Liberty Bonds were awarded for innovation and green bond structure by Environmental Finance, The Bond Buyer, and Clean Energy States Alliance respectively.

For more information on Green Liberty Bonds, visit www.greenlibertybonds.com

## 6.3 Green Liberty Notes

In January of 2022, the Green Bank, in collaboration with Raise Green, began a two-year campaign to raise $2 million by providing an opportunity for citizens to invest as little as $100 to confront climate change. Issuances are anticipated quarterly. Investment by everyday citizens in Green Liberty Notes supports Eversource's SBEA program, administered through the Conservation and Load Management Plan, which helps small businesses reduce their energy consumption through deploying energy efficient equipment. As a result of the climate benefits associated with this program, the offering was reviewed and verified for its environmental attributes by Kestrel Verifiers.

To attract more investors, the program offers one-year maturity notes, with $100 minimums, that are easy to purchase through an online platform without a broker. The Green Liberty Notes were created as an investment companion to Green Liberty Bonds, which have been offered in $1,000 minimums to retail and institutional investors through brokerage firms.

For more information on Green Liberty Notes, visit https://invest.raisegreen.com/offerings

## 6.4 Sustainable CT and Community Match Fund

The strategic partnership between Sustainable CT and the Green Bank is focused on the following key priorities:

- Driving investment in projects in our communities, with a goal to accelerate over time;
- Community-level engagement, from project origination through financing, that is inclusive, diverse, and "knitted";
- Creating a structure that harnesses all types of capital for impact – from donations to investment;
- Developing a business model that covers the cost of the program; and
- Creating a measurable impact, both qualitative and quantitative.

Sustainable CT, in collaboration with Patronicity, has developed a community matching grant platform to raise capital in support of local projects that provide individuals, families, and businesses with funding opportunities to make an impact on sustainability in their communities. This online crowdfunding platform enables citizen leaders to have access to financial resources (i.e., matching grants) that they need to support local sustainability projects.

For more information on Sustainable CT's Community Match Fund, visit https://www.patronicity.com/sustainablect

## 6.5 Community-Based Campaigns

The Green Bank has once again partnered with the Yale School of the Environment,[77] to support USDOE-funded Solar Energy Evolution and Diffusion Study 3 ("SEEDS 3"). SEEDS 3 research builds on nearly a decade of work investigating the peer-to-peer effects of solar PV adoption – how do prospective solar PV customers make the decision to adopt and how do people talk to each other about going solar. Professor Gillingham developed a community-based solar adoption strategy that accelerated the adoption of solar in Connecticut through various Solarize campaigns.[78]

SEEDS 3 expands on this work to investigate the co-adoption of solar, storage, and electric vehicles. The Green Bank will support Professor Gillingham as he initiates and runs community-based solar plus storage campaigns over the next two years. We will leverage the learnings that these campaigns create to refine our storage marketing messages to assist ESS in achieving its goals.

## 6.6 Municipal Assistance Programs

Supported by public policy,[79] the Green Bank continues to support municipalities in their sustainability initiatives through the Solar Marketplace Assistance Program for Towns and Cities ("Solar MAP"). Many Connecticut towns, primarily smaller towns, are challenged to get through the many project steps preventing them from taking advantage of clean energy. Solar MAP provides turnkey support from start to finish to make it easier for towns to identify projects that will provide savings, to access necessary incentives and Green Bank financing, and to add much-needed capacity to manage project implementation and construction. The program administers a competitive solicitation to select a construction partner and bring more projects to the market to grow our state's clean energy economy. Projects are bundled into portfolios to achieve economies of scale driving down project costs and delivering better savings a town wouldn't experience if they acted alone. With feedback from contractors and municipalities, the Green Bank integrated additional transparency into the Programs' status and activities and developed a clearer mission and target audience. Solar MAP aims to support municipalities that are underserved by the market, typically towns that are smaller in population and/or town staff without recent history of doing solar projects. The comprehensive program support and refined mission help better serve municipalities and the clean energy market.

# 7. Investment

The Green Bank pursues investments that advance market transformation in green investing while supporting the organization's pursuit of financial sustainability. With the mission to confront climate change, the Green Bank leverages limited public resources to scale-up and mobilize private capital investment in the green economy of Connecticut.

[77] Professor Ken Gillingham

[78] https://cbey.yale.edu/our-stories/lessons-learned-from-solarize-campaigns-in-connecticut

[79] CGS 16-245n "…stimulate demand for clean energy and deployment of clean energy sources that serve end use customers in the state…" (i.e., 16-245n(c)); and "…shall (i) develop separate programs to finance and otherwise support clean energy investment in residential, municipal, small business and larger commercial projects…" CGS 16-245n(d)(1)(B).

## 7.1 State Funds

The Green Bank receives public revenues from a number of sources that are leveraged to mobilize multiples of private capital investment in the green economy of Connecticut.

**System Benefit Charge**

As its primary source of public revenues, the Green Bank through CGS 16-245n(b) receives a 1 mill per kilowatt-hour surcharge called the CEF from ratepayers of Eversource Energy and Avangrid. The CEF has been in existence since Connecticut deregulated its electric industry in the late 1990s.[8081] On average, households contribute between $7-$10 a year for the CEF, aggregating to about $25 MM per year, which the Green Bank leverages to attract multiples of private capital investment in clean energy through its Financing Programs.

**Regional Greenhouse Gas Emission Allowance Proceeds**

As a secondary source of public revenues, the Green Bank receives a portion (i.e., 23%) of Connecticut's RGGI allowance proceeds through CGS 22a-174(f)(6)(B). The Green Bank invests RGGI proceeds to finance clean energy projects through its Financing Programs. It should be noted that with the passage of PA 22-25, that allowance proceeds received in excess of $5.2 MM from the Green Bank's portion of RGGI, are to be directed to DEEP for the purposes of supporting electric school buses in environmental justice communities.

## 7.2 Federal Funds

The Green Bank receives public revenues through a number of past, current, and future sources[82] of federal funds as well that it leverages to scale-up and mobilize private capital investment in the green economy of Connecticut.

**American Recovery and Reinvestment Act**

Through the American Recovery and Reinvestment Act ("ARRA") the CCEF received $20 million for its programs and initiatives. After nearly $12 million of those funds were invested as grants, the Green Bank invested the remaining $8.2 million in financing programs. With $600,000 of ARRA funds left,[83] the Green Bank invested over $7.6 million of ARRA funds to attract and mobilize $167 million of public and private investment in residential clean energy financing programs.[84]

**United States Department of Agriculture**

The Green Bank has applied to the United States Department of Agriculture ("USDA") to seek access to low-cost and long-term federal loan funds for the deployment of clean energy in rural

[80] PA 98-28 An Act Concerning Electric Restructuring – https://www.cga.ct.gov/ps98/act/pa/1998pa-00028-r00hb-05005-pa.htm

[81] The Clean Energy Fund should not be mistaken with the Conservation Adjustment Mechanism (or the Conservation and Loan Management Fund), which is administered by the EDCs

[82] There have been ongoing public policy proposals at the national level that the Connecticut Green Bank has been a part of to create a US Green Bank. If such a public policy were passed, then the Connecticut Green Bank would have access to significant federal funds to leverage to scale-up and mobilize private capital investment in the green economy of Connecticut.

[83] As of June 30, 2022

[84] https://www.ctgreenbank.com/wp-content/uploads/2022/07/CGB_ARRA_Infographic_2022-4-4-2.pdf ~~https://www.ctgreenbank.com/wp-content/uploads/2022/04/CGB_ARRA_Infographic_2022-4-4.pdf~~

communities.[85] The USDA has vast lending authority under the Rural Electrification Act of 1936, which enables direct loans, project financing and loan guarantees to a variety of borrowers.

**Infrastructure Investment and Jobs Act**

As a result of the IIJA, significant federal resources are being made available to local and state governments through formula grants, and through competitive requests for proposals from budget allocations across many federal agencies. The Green Bank will pursue federal funding to support its programs.

**Greenhouse Gas Reduction Fund**

Within the IRA, is the $27 billion GHGRF modelled after the Connecticut Green Bank. $7 billion under Sec. 134(a)(1) is competitive grants for States, Municipalities, Tribes, and other eligible entities for zero emission technologies (e.g., residential rooftop solar) for low income and disadvantaged communities. Approximately $20 billion under Sec. 134(a)(2-3) is the national climate bank.

## 7.3 Additional Funding Sources

Per CGS 16-245n, additional funding sources include, but are not limited to:

- Charitable gifts, grants, contributions as well as loans from individuals, corporations, university endowments and philanthropic foundations;
- Earnings and interest derived from financing support activities for clean energy projects backed by the Connecticut Green Bank;
- If it qualifies as a CDFI under Section 4702 of the United States Code, funding from the CDFI Fund administered by the United States Department of Treasury, as well as loans from and investments by depository institutions seeking to comply with their obligations under the United States Community Reinvestment Act of 1977; and
- Contracts with private sources to raise capital.

# 8. Impact

The Green Bank's evaluation efforts seek to understand how the increase in investment and deployment of clean energy and environmental infrastructure supported through the Green Bank, result in benefits to society. To that end, the Green Bank has devised an Evaluation Framework and Impact Methodologies for various societal benefits.

## 8.1 Evaluation Framework

The Green Bank has established an Evaluation Framework to guide the assessment, monitoring and reporting of the program impacts and processes, including, but not limited to energy savings and clean energy production and the resulting societal impacts or benefits arising from

[85] "Rural" communities are defined by a population bound and the various limits depend on the program; at the broadest, "rural" may be considered a town that has a population not greater than 50,000 people. Despite its positioning in a mostly-developed corridor, we estimate Connecticut would have 69% of towns eligible at the 20,000-person limit and 89% of towns at the 50,000-person limit.

clean energy investment.[86] This framework focuses primarily on assessing the market transformation the Green Bank is enabling, including:

- **Supply of Capital** – including affordable interest rates, longer term maturity options, improved underwriting standards, etc.

- **Consumer Demand** – increasing the number of projects, increasing the comprehensiveness of projects, etc.

- **Financing Performance Data and Risk Profile** – making data publicly available to reduce perceived technology risks by current or potential private investors.

- **Societal Impact** – the benefits society receives from more investment and deployment of clean energy.

With the goal of pursuing investment strategies that advance market transformation in green investing, the Green Bank's evaluation framework provides the foundation for determining the impact it is supporting in Connecticut and beyond across the four (4) "E's" (i.e., $E^4$) – including Economy, Environment, Energy, and Equity.[87]

The Evaluation Framework will have to be revised, over time, to include environmental infrastructure, as well as the important role Green Liberty Bonds play in raising capital for investments.

## 8.2 Impact Methodologies

To support the implementation of the Evaluation Framework, the Green Bank, working with various public sector organizations, has developed methodologies that estimate the impact from the investment, installation and operation of clean energy projects, including:

- **Jobs** – working in consultation with the Connecticut Department of Economic and Community Development ("DECD"), through the work of Guidehouse (formerly Navigant), the Green Bank devised a methodology that takes investment in clean energy to reasonably estimate the direct, indirect, and induced job-years resulting from clean energy deployment.[88]

- **Tax Revenues** – working in consultation with the Connecticut Department of Revenue Services ("DRS"), through the work of Guidehouse, the Green Bank devised a methodology that takes investment in clean energy to reasonably estimate the individual income, corporate, and sales tax revenues from clean energy deployment.[89]

- **Environmental Protection** – working in consultation with the USEPA and DEEP, the Green Bank devised a methodology that takes the reduction in consumption of energy

[86] https://ctgreenbank.com/wp-content/uploads/2017/02/CTGreenBank-Evaluation-Framework-July-2016.pdf
[87] https://www.ctgreenbank.com/wp-content/uploads/2022/09/FY12-FY22-CGB-ImpactReport-8242022.pdf
~~https://www.ctgreenbank.com/wp-content/uploads/2021/12/FY12-FY21-CGB-ImpactReport-web.pdf~~
[88] https://www.ctgreenbank.com/wp-content/uploads/2018/03/CGB_DECD_Jobs-Study_Fact-Sheet.pdf
[89] https://www.ctgreenbank.com/wp-content/uploads/2018/09/CGB-Eval-Tax-Methodology-7-24-18.pdf

and increase in the production of clean energy to reasonably estimate the air emission reductions (i.e., CO2, NOx, SO2, and PM2.5) resulting from clean energy deployment.[90]

- **Public Health Improvement** – working in consultation with the USEPA, DEEP, and the Connecticut Department of Public Health ("DPH"), the Green Bank devised a methodology that takes air emission reductions to reasonably estimate the public health benefits (e.g., reduced hospitalizations, reduced sick days, etc.) and associated savings to society resulting from clean energy deployment.[91]

- **Equity** – with the passage of PA 20-05, the Green Bank devised a methodology that takes the definition of "vulnerable communities" to track progress towards the goal of ensuring that no less than 40 percent of investment from its programs are directed to vulnerable communities by 2025.[92]

- **Energy Burden** – working in consultation with DEEP and PURA, the Green Bank devised a methodology that takes actual solar PV production data from meters compared against contractual lease and PPA prices, to estimate the energy burden reduction from financing solar PV.[93]

Each year, the Green Bank develops additional methodologies that value the impact the Green Bank is helping create in Connecticut and all of society. For more information on the Green Bank's impact methodologies, visit the Impact page of the website.[94]

In time, additional impact methodologies will be developed for environmental infrastructure.

## 8.3 Green Bond Framework

The Green Bank's Green Bond Framework[95] provides a structure in which the Green Bank can more efficiently and effectively support its efforts to raise capital and deploy more clean energy and environmental infrastructure through the issuance of green bonds.

Connecticut has been at the forefront of state-level efforts to combat the threat of global climate change. In order to increase investment, the Green Bank will use its statutory authority (i.e., CGS 16-245kk) to issue bonds, including green bonds. These are key to sourcing capital for clean energy and environmental infrastructure projects and providing a way for all residents, businesses, and institutions of Connecticut to invest in growing our green economy.

The framework sets out how the Green Bank proposes to use its Master Trust Indenture ("MTI") in a manner consistent with its purpose and provide the transparency and disclosures investors require to make investment decisions through green bonds. This framework is

[90] https://www.ctgreenbank.com/wp-content/uploads/2018/01/CGB-Eval-IMPACT-091917-Bv2.pdf
[91] https://www.ctgreenbank.com/wp-content/uploads/2018/03/CGB-Eval-PUBLICHEALTH-1-25-18-new.pdf
[92] https://www.ctgreenbank.com/wp-content/uploads/2022/07/Equity_Investment_in_Vulnerable_Communities.pdf ~~https://www.ctgreenbank.com/wp-content/uploads/2021/10/Equity_Investment_in_Vulnerable_Communities.pdf~~
[93] https://www.ctgreenbank.com/wp-content/uploads/2022/07/CGB-Eval-Solar-Methodology-combined-6-8-2021-final.pdf ~~https://www.ctgreenbank.com/wp-content/uploads/2021/09/CGB-Eval-Solar-Methodology-combined-6-8-2021-final.pdf~~
[94] https://www.ctgreenbank.com/strategy-impact/evaluations/ ~~https://www.ctgreenbank.com/strategy-impact/impact/societal-impacts/~~
[95] https://ctgreenbank.com/wp-content/uploads/2020/04/CGB_Green-Bond-Framework_final-4-22-2020.pdf

specifically intended for the MTI approved and adopted April 22, 2020, which establishes the purposes for which the Green Bank may issue green bonds or other public debt. The Framework is established in accordance with the Climate Bonds Initiative ("CBI") Standard and adheres to the Green Bond Principles issued by the International Capital Market Association.

The Green Bond Framework will have to be revised, over time, to include environmental infrastructure.

# 9. Reporting and Transparency

The Green Bank has extensive reporting on its financial management and societal impact through various mechanisms. As a recipient of public revenues (i.e., CEF and RGGI allowance proceeds), the Green Bank believes that complete transparency is important to ensure the public's continued trust in serving its purpose. The Green Bank reports to the Governor's Office (i.e., Office of Policy and Management ("OPM")), various committees of cognizance within the CGA (i.e., energy & technology, commerce, environment, and banking), and other departments (e.g., DEEP, Office of Fiscal Analysis).

## 9.1 Annual Comprehensive Financial Report

An Annual Comprehensive Financial Report ("ACFR") is a set of government financing statements that includes the financial report of a state, municipal or other government entity that complies with the accounting requirements promulgated by the Governmental Accounting Standards Board ("GASB"). GASB provides standards for the content of an ACFR in its annually updated publication *Codification of Governmental Accounting and Financial Reporting Standards*. An ACFR is compiled by a public agency's accounting staff and audited by an external American Institute of Certified Public Accountants ("AICPA") certified accounting firm utilizing GASB requirements. It is composed of three sections – Introductory, Financial, and Statistical. The independent audit of the ACFR is not intended to include an assessment of the financial health of participating governments, but rather to ensure that users of their financial statements have the information they need to make those assessments themselves.[96]

To date, the Green Bank has issued eight ACFR's, including:

- Fiscal Year Ended June 30, 2014 (Certificate of Achievement)
- Fiscal Year Ended June 30, 2015 (Certificate of Achievement)
- Fiscal Year Ended June 30, 2016 (Certificate of Achievement)
- Fiscal Year Ended June 30, 2017 (Certificate of Achievement)
- Fiscal Year Ended June 30, 2018 (Certificate of Achievement)
- Fiscal Year Ended June 30, 2019 (Certificate of Achievement)
- Fiscal Year Ended June 30, 2020 (Certificate of Achievement)
- Fiscal Year Ended June 30, 2021 (Certificate of Achievement)
- Fiscal Year Ended June 30, 2022

[96] The Government Finance Officers Association (GFOA), founded in 1906, represents public finance officials throughout the United States and Canada. GFOA's mission is to enhance and promote the professional management of governmental financial resources by identifying, developing, and advancing fiscal strategies, policies, and practices for the public benefit. GFOA established the Certificate of Achievement for Excellent in Financial Reporting Program in 1945 to encourage and assist state and local governments to go beyond the minimum requirements of generally accepted accounting principles to prepare CAFRs that evidence the spirit of transparency and full disclosure and then to recognize individual governments that succeed in achieving that goal.

As the "gold standard" in government reporting, the ACFR is the mechanism the Green Bank uses to report its fiscal year financial, investment, and impact performance to its stakeholders. For each of its seven years filing the ACFR with the Government Finance Officers Association the Green Bank has received a Certificate of Achievement for Excellence in Financial Reporting.[97]

## 9.2 Annual Report

Beyond the ACFR, the annual reports of the Green Bank are compiled by the marketing staff and include consolidated financial statement information and narratives of various program achievements in a condensed format that can be widely distributed.

To date, the Green Bank has issued ten annual reports, including:

- Fiscal Year 2012 Annual Report
- Fiscal Year 2013 Annual Report
- Fiscal Year 2014 Annual Report
- Fiscal Year 2015 Annual Report
- Fiscal Year 2016 Annual Report
- Fiscal Year 2017 Annual Report
- Fiscal Year 2018 Annual Report
- Fiscal Year 2019 Annual Report
- Fiscal Year 2020 Annual Report
- Fiscal Year 2021 Annual Report
- Fiscal Year 2022 Annual Report

## 9.3 Auditors of Public Accounts

The office of the Auditors of Public Accounts ("APA") is a legislative agency of the State of Connecticut whose primary mission is to conduct audits of all state agencies, including quasi-public agencies. Included in such audits is an annual Statewide Single Audit of the State of Connecticut to meet federal requirements. The office is under the direction of two state auditors appointed by the state legislature. The APA audited certain operations of the Green Bank in fulfillment of its duties under Sections 1-122 and Section 2-90 of the CGS

To date, the APA has conducted four audits, including:

- Fiscal Years 2012 and 2013
- Fiscal Years 2014 and 2015
- Fiscal Years 2016 and 2017
- Fiscal Years 2018 and 2019

## 9.4 Open Connecticut and Open Quasi

Open Connecticut centralizes state financial information to make it easier to follow state dollars. In Connecticut quasi-public agencies are required to submit annual reports to the legislature, including a summary of their activities and financial information. In addition to that, the Comptroller's Office requested that quasi-public agencies voluntarily provide payroll and

[97] GAO has yet to designate the FY 2021 ACFR with a Certificate of Achievement

checkbook-level vendor payment data for display on Open Connecticut. The Green Bank, which was among the first quasi-public organizations to participate, has voluntarily submitted this information since the inception of Open Connecticut.[98] In June of 2020, the Comptroller launched Open Quasi, which provides payroll and checkbook level data for all quasi-public organizations in Connecticut.

For more information, go to https://openquasi.ct.gov/

## 10. Research and Product Development

As the Green Bank implements its Comprehensive Plan, there will be ongoing efforts to develop market opportunities for future green investments. With the lessons being learned and best practices being discovered in the green economy, the Green Bank's ability to deliver more societal benefits requires understanding potential opportunities and the development of pilot programs and initiatives to increase and measure impact, including, for example:

- **Ecosystems Services** – increasing understanding of ecosystem services values from environmental infrastructure, will help to identify opportunities to mobilize private investment to maximize GHG emissions reductions and resiliency against climate change. Ongoing support of research studies to understand the value of ecosystem services from environmental infrastructure is important.

- **Carbon Offsets** – continuing to increase understanding of carbon offsets,[99] recognizing their importance within environmental infrastructure (e.g., forest carbon, climate-smart agriculture) and the potential to generate revenues in support of projects, there is need for ongoing support of research studies to understand carbon offset markets.

- **Resiliency** – in its efforts to advance resilience, the Green Bank working with DEEP, Insurance Department, and CIRCA, will seek to better understand labelling (e.g., FORTIFIED by the Insurance Institute for Business and Home Safety), direct install measures, and other programs (e.g., adapting Solarize campaigns to Ruggedize campaigns). To continue to develop ESS, research and pilots for vehicle to grid ("V2G") will also be pursued.

- **Electric School Buses** – per Public Act 22-25, the Green Bank supported contract extensions for electric school buses ("ESB") and financial support through RGGI for vouchers in support of ESB deployment in environmental justice communities through the Connecticut Hydrogen and Electric Automobile Purchase Rebate ("CHEAPR") program. Support for the deployment of ESBs and electric vehicle supply equipment ("EVSE") will enable increased private investment to support the 100% zero emission ESB goals for 2030 (i.e., environmental justice communities) and 2040 (i.e., all communities).

[98] https://openquasi.ct.gov/

[99] Verified Carbon Standard – VM0038 Methodology for Electric Vehicle Charging Systems (V1.0) – https://verra.org/methodology/vm0038-methodology-for-electric-vehicle-charging-systems-v1-0/

- **Hydrogen** – per Special Act 22-8,[100] and consistent with the definition of "clean energy" under CGS 16-245n, the Green Bank is chair of the task force to study hydrogen power. Recognizing the importance of "green hydrogen" to Connecticut's fuel cell industry, there may be the need for research on the sources, infrastructure, and uses related to hydrogen.

- **Impact Methodologies** – building on the Green Bank's leading impact methodologies for "clean energy," efforts will be undertaken to develop impact methodologies for "environmental infrastructure".

- **Battery Recycling** – as the co-administrator of the 580 MW Energy Storage Solutions program, understanding the implications, challenges, and opportunities for battery recycling (e.g., lithium-ion batteries) is important.

The Green Bank's research product development efforts are intended to open-up new market channels for private investment in Connecticut's green economy through studies, pilot projects, and other initiatives that have the potential for expanding the impact of the Green Bank.

# 11. Budget

## 11.1 FY 2023 Budget

For the details on the FY 2023 budget– click here.

For details on the FY 2023 revised budget – click here.

[100] An Act Establishing a Task Force to Study Hydrogen Power – https://www.cga.ct.gov/2022/ACT/SA/PDF/2022SA-00008-R00HB-05200-SA.PDF

## 12. Glossary of Acronyms

| | |
|---|---|
| ABS | Asset-Backed Security |
| ACFR | Annual Comprehensive Financial Report |
| ACG Committee | Audit, Compliance, and Governance Committee |
| AICPA | American Institute of Certified Public Accountants |
| APA | Auditors of Public Accounts |
| ARRA | American Recovery and Reinvestment Act |
| BEA | Business Energy Advantage |
| BIL | Bipartisan Infrastructure Law |
| BOC Committee | Budget, Operations, and Compensation Committee |
| BOD | Board of Directors |
| CBI | Climate Bonds Initiative |
| CCEF | Connecticut Clean Energy Fund |
| CDFI | Community Development Financial Institution |
| CEF | Clean Energy Fund |
| CGA | Connecticut General Assembly |
| CGS | Connecticut General Statutes |
| CHEAPR | Connecticut Hydrogen and Electric Automobile Purchase Rebate |
| CIRCA | Connecticut Institute for Resilience and Climate Adaptation |
| C-PACE | Commercial Property Assessed Clean Energy |
| DECD | Department of Economic and Community Development |
| DEEP | Department of Energy and Environmental Protection |
| DoAg | Department of Agriculture |
| DPH | Department of Public Health |
| DRS | Department of Revenue Services |
| EDC | Electric Distribution Company |
| ESB | Electric School Bus |
| EEB | Energy Efficiency Board |
| EIF | Environmental Infrastructure Fund |
| ESS | Energy Storage Solutions |
| EM&V | Evaluation, Measurement, and Verification |
| EVSE | Electric Vehicle Supply Equipment |
| GASB | Governmental Accounting Standards Board |
| GHG | Greenhouse Gas Emissions |
| GHGRF | Greenhouse Gas Reduction Fund |
| GWSA | Global Warming Solutions Act |
| HES | Home Energy Solutions |
| HES-IE | Home Energy Solutions – Income Eligible |
| IPC | Inclusive Prosperity Capital |
| IIJA | Infrastructure Investments and Jobs Act |
| IRA | Inflation Reduction Act |
| LMI | Low-to-Moderate Income |
| MPA | Master Purchase Agreement |
| MTI | Master Trust Indenture |
| NRCS | Natural Resources Conservation Service |

| | |
|---|---|
| NRES | Non-Residential Renewable Energy Solutions |
| OPM | Office of Policy and Management |
| PA | Public Act |
| PDR | Purchasing Development Rights |
| PPA | Power Purchase Agreement |
| PURA | Public Utilities Regulatory Authority |
| RGGI | Regional Greenhouse Gas Initiative |
| RPS | Renewable Portfolio Standard |
| RRES | Residential Renewable Energy Solutions |
| RSIP | Residential Solar Investment Program |
| SBEA | Small Business Energy Advantage |
| SCORP | Statewide Comprehensive Outdoor Recreation Plan |
| SCRF | Special Capital Reserve Fund |
| SHREC | Solar Home Renewable Energy Credit |
| SRF | State Revolving Fund |
| TPL | Trust for Public Land |
| URI | Urban Resources Institute |
| USDA | U.S. Department of Agriculture |
| USDOE | U.S. Department of Energy |
| USEPA | United States Environmental Protection Agency |
| V2G | Vehicle to Grid |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# Capital Solutions RFP

## A Funding Facility for PosiGen, Inc.
## Senior Secured Revolving Bridge Loan Facility

## (Amended and Restated Resolutions)

## January 13, 2023

PosiGen
Solar Energy and Energy Efficiency


**Document Purpose:** This document contains background information and due diligence on a proposed $6.0 million funding facility for PosiGen, Inc. created through the Connecticut Green Bank's Capital Solutions Open RFP program. The information herein is provided to the Connecticut Green Bank Board of Directors for the purposes of reviewing and approving recommendations made by the staff of the Connecticut Green Bank.

In some cases, this package may contain, among other things, trade secrets and commercial or financial information given to the Connecticut Green Bank in confidence and should be excluded under C.G.S. §1-210(b) and §16-245n(D) from any public disclosure under the Connecticut Freedom of Information Act. If such information is included in this package, it will be noted as confidential.

# Memo

**To:** Connecticut Green Bank Board of Directors

**From:** Bert Hunter, EVP and CIO

**Cc:** Bryan Garcia, President and CEO; Brian Farnen, General Counsel and CLO; Mackey Dykes, VP Financing Programs and Officer; Jane Murphy, EVP Finance & Administration

**Date:** January 13, 2023

**Re:** PosiGen, Inc. Capital Solutions Open RFP Proposal (Tax Equity Bridge / Final Documents)

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**Summary**

In December, the Green Bank Board of Directors (the "Board"), approved an application by PosiGen Green Bank's Capital Solutions Open RFP program for a 2-year $6 million loan facility to bridge certain tax equity investments for its solar funds as well as to bridge certain tax benefits associated with the recently passed Inflation Reduction Act. (See attached to this memorandum a copy of the memo (the "Capital Solutions Memo") submitted by staff to the Board concerning PosiGen's application.) The transaction has now been documented in conformity with the description of the facility found in the Capital Solutions Memo. In reviewing the structure of the transaction as outlined in the Capital Solutions Memo, legal counsel recommended modifying the resolutions of the Board approving the facility to bring the resolutions more in conformity with the transaction described in the Capital Solutions Memo. Staff agrees. Accordingly, the purpose of this memorandum is to briefly explain the specific matter in the December resolutions that does not strictly conform with the transaction as described in the Capital Solutions Memo and to request that the Board modify those resolutions so that they can be brought in line with the transaction described in the Capital Solutions Memo.


## Tax Equity Bridge

As explained in the Capital Solutions Memo, Green Bank will provide a revolving tax equity bridge with the following key terms:

- Green Bank commitment of $6 million, on a delayed draw basis, with a total commitment inclusive of third-party capital / participants not to exceed $12 million
    - Potential participants include Inclusive Prosperity Capital and the Candide Group's new climate justice fund, both of which organizations have prior or existing exposure to PosiGen and have expressed significant interest in joining this facility
    - For the avoidance of doubt, the Green Bank would be able to fund in advance of participant commitments, in line with precedent transactions, but then bring in those participant dollars on a follow-on basis, reducing Green Bank's exposure
- Advances to be provided against projects expected to qualify for the various ITC adders, at a 90% advance rate

- Maturity on the bridge not to exceed twelve months
- Interest rate of 9%, with a minimum multiple on invested capital to the Green Bank of at least 1.02x
- 1% closing fee ($60,000) payable in 12 equal monthly installments

In line with the above, and as previously mentioned, PosiGen expects to close on $50 million in new tax equity capacity with M&T Bank in early 2023. However, given that PosiGen's current tax equity commitments expired in December, there is a short-term funding gap. Staff proposed (and the Board approved) that $6 million be made available for the timing delays referenced above and also be made available to fund against tax equity proceeds that PosiGen would expect to receive as part of its first tranche of capital from its new provider in early 2023. As these funds are advanced by tax equity to the PosiGen SPV, the money will be directed to a blocked cash collateral account under the irrevocable control of Green Bank. Contrary to what was mentioned in the Board resolutions in December, this is not strictly be a "1st lien financing" – but secured by payment direction and blocked accounts. Once repaid, these funds could then revolve for the purpose of bridging ITC adders for the remainder of the year.

### Recommendation

Green Bank staff recommends the Board AMEND AND RESTATE the resolutions passed at the December meeting to be in conformity of the final documentation which reflects the Capital Solutions Memo as clarified by this memorandum.

## Amended and Restated Resolutions

**WHEREAS**, the Connecticut Green Bank ("Green Bank") has an existing partnership with PosiGen, Inc. (together with its affiliates and subsidiaries, "PosiGen") to support PosiGen in delivering a solar lease (including battery storage) and energy efficiency financing offering to LMI households in Connecticut;

**WHEREAS**, the Green Bank Board of Directors ("Board) previously authorized and later amended the Green Bank's participation in a back leverage credit facility (the "BL Facility") collateralized by all of PosiGen's solar PV system and energy efficiency leases in the United States as part of the company's strategic growth plan, as well as a facility to finance performance based incentives earned by PosiGen on its solar PV portfolio in Connecticut;

**WHEREAS**, PosiGen repayment performance is satisfactory;

**WHEREAS**, the passage of the federal Inflation Reduction Act of 2022 (the "IRA") creates a variety of new tax credit value streams that are available in early 2023 but likely to be delayed in terms of monetizable cash flow as explained in the memorandum to the Board dated December 9, 2022 (the "Board Memo");

**WHEREAS**, PosiGen is currently documenting a new tax equity facility that will incorporate that additional value from IRA and has applied under the Capital Solutions Open RFP program for a revolving loan facility (the "Facility") to bridge this value to be derived from the IRA provisions being included in the Internal Revenue Code, as further explained in the Board Memo;

**WHEREAS**, Staff has advised the Board that legal counsel has recommended modification of the resolutions in respect of the Facility explained in the December Board Memo to be in conformity with the final documentation for the Facility, and staff agrees with legal counsel and recommends the Board amend and restate the resolutions passed in December 2022 in respect of the Facility; and

**NOW**, therefore be it:

**RESOLVED,** that the Green Bank Board of Directors (the "Board") amends and restates the resolutions passed during a meeting of the Board held December 16, 2022 as follows:

**RESOLVED,** that the Green Bank may advance up to $6 million in ~~1st lien~~ an uncommitted, discretionary financing associated with tax equity cash flows, to be remitted as capital contributions by a member of the affiliated SPV directly to the SPV, under a revolving loan facility, under a revolving loan facility as further explained in the Board Memo; and

**RESOLVED**, that the Green Bank may make the advances to the existing Borrower for distribution to the SPV, to be repaid through the Managing Member of the SPV to a blocked cash collateral account under the irrevocable control of Green Bank, as further explained in the Board 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

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Historic Cargill Falls Mill

# A C-PACE Project in Putnam, CT

## Green Bank C-PACE Facility Modification Request

## January 17, 2023

**Document Purpose:** This document contains background information and due diligence on a proposed modification of a credit facility for the hydroelectric repowering and gut rehabilitation financing for energy efficiency measures using C-PACE for this project located in Putnam, CT. The information herein is provided to the Connecticut Green Bank Board of Directors for the purposes of reviewing and approving recommendations made by the staff of the Connecticut Green Bank.

In some cases, this package may contain, among other things, trade secrets and commercial or financial information given to the Connecticut Green Bank in confidence and should be excluded under C.G.S. §1-210(b) and §16-245n(D) from any public disclosure under the Connecticut Freedom of Information Act. If such information is included in this package, it will be noted as confidential.

# Memo

**To:** Connecticut Green Bank Board of Directors

**From:** Bert Hunter, EVP and CIO; Mariana Trief, Associate Director, Investments

**Cc:** Bryan Garcia, President and CEO; Brian Farnen, General Counsel and CLO; Mackey Dykes, VP Financing Programs; Alex Kovtunenko, Associate General Counsel

**Date:** January 17, 2023

**Re:** Historic Cargill Falls Mill Redevelopment Project: Update & Proposed Investment Modification

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**General Update & Proposed Investment Summary**

Staff of the Connecticut Green Bank ("Green Bank") returns to the Green Bank's Board of Directors (the "Board") to report on progress for the C-PACE project at 58 Pomfret Street, Putnam, CT (the "Historic Cargill Falls Mill", "HCFM" or "Project") and to recommend a modification to the repayment terms of the outstanding C-PACE financing, due to delays in finalizing the hydro installation as further explained in this memo.

The Project continues to be a residential success. As of December 2022, vacancy rates remain low (at 6% consistent with other multifamily properties). There are a total of 45 applicants on the wait list. In December of 2022 lead exposure was discovered within the property by the Northeast District Department of Health. This exposure will require abatement and is further described below under the Building Update. While residential lease-up has been successful, leasing of the commercial space has, understandably, been slower to fill amidst COVID. To date four small office spaces and three large spaces have been leased up. The annual projected income from the leased up commercial spaces for 2023 is $110,000. There continue to be a few storage spaces that have not been leased up and the largest commercial/retail space suitable for a restaurant is still vacant. The hydro project (which will soon be online) has been delayed (more info provided in the Hydro Update Section below), which has resulted in higher electricity costs than budgeted. This is affecting Cargill's ability to make debt service payments. Therefore, as explained herein, Green Bank staff is proposing a further amendment to the Financing Agreement so that a portion of the principal and interest ("P&I") payments due until December 2024 (when the construction loan to Haynes Construction are scheduled to be fully paid off) is added to the $1M second C-PACE benefit assessment lien and modifying the associated liens to reflect this. This is further discussed below in the section entitled: "Recommended Adjustment to C-PACE Funding".

**Building Update**

On December 14, 2022 the property was made aware of a lead concern in one of the apartments at Cargill Falls. The Northeast District Department of Health (NDDH) confirmed that the apartment had been tested, excessive levels of lead were found, and would require abatement. The NDDH provided a Lead Abatement Order for the tested apartment and the plan was completed on January 13, 2022 by an environmental consultant engaged for the property by the property management company (Konover). NDDH has performed inspections in a total of 23 additional units; 8 comprehensive inspections (in units where children younger than 6 reside – this age threshold is relevant to how lead exposures are required to be handled pursuant to CT statutes); 3 risk assessments; 12 visual inspections and dust wipes for the common areas. Comprehensive results from the additional testing is still pending. To the extent those apartments also require

abatement, the property will undertake the same process to submit an abatement plan to NDDH for approval and complete the required abatement. Ownership plans to undertake a more comprehensive plan that involves testing, visual inspection, and, if necessary, remediation/abatement of the property beyond the apartment units tested by NDDH. The letters sent to residents from NDDH and the property owner are provided as exhibit A.

**Hydro Project Update**

The Hydro Project consists of two turbines. The larger 600 kW turbine was placed in service in May 2017 but was then taken offline during the construction work associated with the redevelopment. Work to enable the smaller 300 kW unit to come online was anticipated as part of the mill redevelopment, but the permit from the DOT ("DOT Permit") which was required to complete the bifurcation work was delayed. The DOT Permit was granted, and while staff had ultimately expected the work to be completed by mid-August, there were delays associated with obtaining approval to commence the work and finding subcontractors to finish the work. Ultimately this was finalized in late October 2022. During November and December after the bifurcation work was completed, the engineer worked to finalize the items that were pending such as controls, head gates and programming to allow the water to flow and turbines to begin generating electricity. All of that work required to begin operation has been completed since mid-December for Turbine 2[1] including watering up the tunnel to test for leakage. However, the project has been unable to begin operation as there was no equipment breakdown insurance in place. The traditional hydro insurance markets that have been used for other hydro projects Green Bank is involved with, did not want to provide coverage given the co-habitational risk. Roy Ivins, Green Bank's insurance consultant, was finally able to secure a proposal from HSB through RK Carignan and the project is anticipating being able to bind the insurance this week. The cost of insurance is also moderately higher than had originally been anticipated. With the binding of insurance, the project team does not anticipate any further delays to begin operation.

These delays have affected the property's cash flow. Annually staff expects approximately $130k in reduced electricity costs, $270k in ZREC revenue and $61k in excess generation sold to the grid. The reduced income affect's the Project's ability to make the debt payments associated with the C-PACE financing.

**Recommended Adjustment to C-PACE Funding**

The current Green Bank C-PACE funding, in accordance with previous Board Approvals, is structured as follows:

i. First Benefit Assessment Lien (as defined in the Financing Agreement) of $8,811,116.72 (composed of the approved $7.1M C-PACE financing + $1.7M in capitalized interest)
    a. Repayable over 35 years at 5% interest rate
    b. Repayment start date of July 1, 2022. However, the principal payment due on July 2022 was added to the Second Benefit Assessment lien to allow the Project to recover from the delays to the Hydro.
    c. Supplemental Interest: 0.95% interest from available cash flow paid annually after financials are submitted

ii. Second Benefit Assessment Lien: $1,000,000
    a. Repayable over 10 years at 5% interest
    b. Repayment start date of January 1, 2022
    c. A 3-1/2 year interest only period ending 1/1/2025[2]

[1] A few sensors needed for Turbine 1 have been delayed but are expected by late January so that the smaller Turbine can also start to operate.

[2] The extension of the maturity is to allow for payment to Haynes of the ~$725k short term note.

iii. Cash Flow Sweep: In addition to payments above, a 100% cash flow sweep based on annual available cash flow
    a. Due until Second Benefit Assessment Lien is paid in full
    b. Payments are applied to Second Benefit Assessment lien in inverse order of maturity

The existing Lien payment schedules are provided as Exhibit B. Green Bank staff is proposing that a portion of the P&I payments associated with the First Benefit Assessment Lien due until December 2024 (when the loan to Haynes is fully repaid) is "paid" by being added to the Second Benefit Assessment Lien. We used this process for the first payment that would have been payable in July 2022. Specifically, 80% of the P&I payments due in 2023 and 2024 would be added to the Second Benefit Assessment Lien; with the remainder of the payments due to be paid by the Project. The new proposed Lien schedules are provided as Exhibit C. The Second Benefit Assessment Lien will show an increase in principal in 2023 and 2024 to account for the portion of the P&I payments from the First Benefit Assessment Lien. Staff also proposes to extend the term of the Second Benefit Assessment Lien from 10 years to 15 years to ensure cash flows are sufficient for repayment of the financing (but with a cash sweep in place so the actual paydown could potentially occur more quickly depending upon revenues available).

The proposed change will allow the building to recover from the higher electricity costs as a result of the delays associated with the hydro project and additional lead abatement costs that may be necessary, while ensuring the Green Bank's C-PACE financing is repaid in full over time. Subject to Green Bank's approval and prior to amending the Financing Agreement, staff will confirm the C-PACE Savings to Investment Ratio ("SIR") requirement. [3] In addition, other Project lenders who holds mortgages will need to provide consent to the amendment.

While staff is not pleased that due to a number of project delays and now the cost of lead abatement pushes back the repayment of the Green Bank financing, the project remains fully leased in an area where there remains a shortage of quality rental units. As such, over time staff is confident that with the hydro project providing meaningful economic benefits for the cost of energy in an environment where energy costs are increasing dramatically, the property should remain attractive for many years and generate stable cash flow for debt service. Accordingly, staff believes approval is warranted and requests this approval from the Board.

[3] Green Bank's technical consultant, DNV, had confirmed in July 2021 the project had an SIR of 1.05 and an estimated useful life (for the SIR analysis) of 15 years for HVAC upgrades, 10 years for domestic hot water upgrades and 40 years for on-site hydro, combined: 35.6 years. The SIR would be updated to reflect the ~$260k increase.

**Resolutions**

**WHEREAS**, pursuant to Conn. Gen. Stat. 16a-40g, the Connecticut Green Bank ("Green Bank") has established a commercial sustainable energy program for Connecticut, known as Commercial Property Assessed Clean Energy ("C-PACE");

**WHEREAS**, the Board of Directors ("Board") of the Green Bank previously approved a construction and term financing, secured by a C-PACE benefit assessment lien, not-to-exceed amount of $8,100,000 (the "Current Lien") to Historic Cargill Falls Mill, LLC ("HCFM"), the property owner of 52 and 58 Pomfret Street, Putnam, Connecticut, to finance the construction of specified clean energy measures (the "Project") in line with the State's Comprehensive Energy Strategy and the Green Bank's Strategic Plan;

**WHEREAS**, the Project includes numerous energy conservation measures that align with the goals and priorities of the Green Bank's multifamily housing program;

**WHEREAS**, Green Bank staff now seeks approval to amend the Current Lien to HCFM to provide non-cash funding (the "Financing Amendment") for the Project, to account for an extension of time to repay principal and interest for the Project as explained in the memorandum in respect of this matter submitted to the Board on January 17, 2023 (the "Board Memo").

**NOW**, therefore be it:

**RESOLVED,** that the President of the Green Bank and any other duly authorized officer of the Green Bank is authorized to execute and deliver the Loan Amendment in a total amount not to exceed the sum of (i) the Current Lien being secured by a C-PACE benefit assessment, plus any and all interest accrued as a result of the principal and interest deferral as explained in the Board Memo with terms and conditions consistent with the Board Memo, and as he or she shall deem to be in the interests of the Green Bank and the ratepayers no later than 180 days from January 20, 2022; and

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

Submitted by: Bryan Garcia, President and CEO; Bert Hunter, EVP and CIO; Mariana Trief, Associate Director, Investments; Mackey Dykes, VP Financing Programs

## Exhibit B
## Current Lien Schedules

### Cargill Falls - PT-100040

**Benefit Assessment Installment Payment Schedule**
**Benefit Assessment Advance + Capitalized Interest = $8,800,852.40**
**Principal: $7,095,648.72; Capitalized Interest: $1,705,203.68**
**Interest Rate: 5.00%; Semiannual Installments: 70**
**Final Disbursement Date: 6/24/2022**

| Payment Date | Lien 1 Special Int PMT | Payment | Principal Paid | Interest Paid | Remaining Balance | Total Payment |
|---|---|---|---|---|---|---|
| - | | - | $8,800,852.40 | - | - | |
| 7/1/2022 | | $263,594.25 | $255,037.87 | $8,556.38 | $8,545,814.53 | $263,594.25 |
| 1/1/2023 | $42,853.80 | $263,594.25 | $45,201.21 | $218,393.04 | $8,500,613.32 | $306,448.05 |
| 7/1/2023 | | $263,594.25 | $49,898.28 | $213,695.97 | $8,450,715.04 | $263,594.25 |
| 1/1/2024 | $81,165.54 | $263,594.25 | $47,631.53 | $215,962.72 | $8,403,083.51 | $344,759.79 |
| 7/1/2024 | | $263,594.25 | $51,182.97 | $212,411.28 | $8,351,900.54 | $263,594.25 |
| 1/1/2025 | $80,421.90 | $263,594.25 | $50,156.79 | $213,437.46 | $8,301,743.75 | $344,016.15 |
| 7/1/2025 | | $263,594.25 | $54,897.64 | $208,696.61 | $8,246,846.11 | $263,594.25 |
| 1/1/2026 | $79,176.59 | $263,594.25 | $52,841.52 | $210,752.73 | $8,194,004.59 | $342,770.84 |
| 7/1/2026 | | $263,594.25 | $57,606.08 | $205,988.17 | $8,136,398.51 | $263,594.25 |
| 1/1/2027 | $78,099.06 | $263,594.25 | $55,664.07 | $207,930.18 | $8,080,734.44 | $341,693.31 |
| 7/1/2027 | | $263,594.25 | $60,453.56 | $203,140.69 | $8,020,280.88 | $263,594.25 |
| 1/1/2028 | $76,966.21 | $263,594.25 | $58,631.52 | $204,962.73 | $7,961,649.36 | $340,560.46 |
| 7/1/2028 | | $263,594.25 | $62,341.45 | $201,252.80 | $7,899,307.91 | $263,594.25 |
| 1/1/2029 | $75,994.45 | $263,594.25 | $61,723.05 | $201,871.20 | $7,837,584.86 | $339,588.70 |
| 7/1/2029 | | $263,594.25 | $66,566.08 | $197,028.17 | $7,771,018.78 | $263,594.25 |
| 1/1/2030 | $74,534.40 | $263,594.25 | $65,001.55 | $198,592.70 | $7,706,017.23 | $338,128.65 |
| 7/1/2030 | | $263,594.25 | $69,873.54 | $193,720.71 | $7,636,143.69 | $263,594.25 |
| 1/1/2031 | $73,218.56 | $263,594.25 | $68,448.36 | $195,145.89 | $7,567,695.33 | $336,812.81 |
| 7/1/2031 | | $263,594.25 | $73,350.80 | $190,243.45 | $7,494,344.53 | $263,594.25 |
| 1/1/2032 | $71,835.16 | $263,594.25 | $72,072.11 | $191,522.14 | $7,422,272.42 | $335,429.41 |
| 7/1/2032 | | $263,594.25 | $75,975.70 | $187,618.55 | $7,346,296.72 | $263,594.25 |
| 1/1/2033 | $70,584.66 | $263,594.25 | $75,855.56 | $187,738.69 | $7,270,441.16 | $334,178.91 |
| 7/1/2033 | | $263,594.25 | $80,823.44 | $182,770.81 | $7,189,617.72 | $263,594.25 |
| 1/1/2034 | $68,862.24 | $263,594.25 | $79,859.57 | $183,734.68 | $7,109,758.15 | $332,456.49 |
| 7/1/2034 | | $263,594.25 | $84,862.83 | $178,731.42 | $7,024,895.32 | $263,594.25 |
| 1/1/2035 | $67,255.20 | $263,594.25 | $84,069.15 | $179,525.10 | $6,940,826.17 | $330,849.45 |
| 7/1/2035 | | $263,594.25 | $89,109.59 | $174,484.66 | $6,851,716.58 | $263,594.25 |
| 1/1/2036 | $65,565.66 | $263,594.25 | $88,494.83 | $175,099.42 | $6,763,221.75 | $329,159.91 |
| 7/1/2036 | | $263,594.25 | $92,635.03 | $170,959.22 | $6,670,586.72 | $263,594.25 |
| 1/1/2037 | $63,974.58 | $263,594.25 | $93,123.70 | $170,470.55 | $6,577,463.02 | $327,568.83 |
| 7/1/2037 | | $263,594.25 | $98,244.14 | $165,350.11 | $6,479,218.88 | $263,594.25 |
| 1/1/2038 | $61,931.56 | $263,594.25 | $98,014.21 | $165,580.04 | $6,381,204.67 | $325,525.81 |
| 7/1/2038 | | $263,594.25 | $103,177.85 | $160,416.40 | $6,278,026.82 | $263,594.25 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1/1/2039 | $59,968.73 | $263,594.25 | $103,155.79 | $160,438.46 | $6,174,871.03 | $323,562.98 |
| 7/1/2039 | | $263,594.25 | $108,364.85 | $155,229.40 | $6,066,506.18 | $263,594.25 |
| 1/1/2040 | $57,905.13 | $263,594.25 | $108,561.31 | $155,032.94 | $5,957,944.87 | $321,499.38 |
| 7/1/2040 | | $263,594.25 | $112,990.64 | $150,603.61 | $5,844,954.23 | $263,594.25 |
| 1/1/2041 | $55,897.90 | $263,594.25 | $114,223.20 | $149,371.05 | $5,730,731.03 | $319,492.15 |
| 7/1/2041 | | $263,594.25 | $119,530.04 | $144,064.21 | $5,611,200.99 | $263,594.25 |
| 1/1/2042 | $53,463.15 | $263,594.25 | $120,196.89 | $143,397.36 | $5,491,004.10 | $317,057.40 |
| 7/1/2042 | | $263,594.25 | $125,556.51 | $138,037.74 | $5,365,447.59 | $263,594.25 |
| 1/1/2043 | $51,065.58 | $263,594.25 | $126,477.26 | $137,116.99 | $5,238,970.33 | $314,659.83 |
| 7/1/2043 | | $263,594.25 | $131,892.36 | $131,701.89 | $5,107,077.97 | $263,594.25 |
| 1/1/2044 | $48,544.91 | $263,594.25 | $133,080.04 | $130,514.21 | $4,973,997.93 | $312,139.16 |
| 7/1/2044 | | $263,594.25 | $137,862.64 | $125,731.61 | $4,836,135.29 | $263,594.25 |
| 1/1/2045 | $46,029.21 | $263,594.25 | $140,004.13 | $123,590.12 | $4,696,131.16 | $309,623.46 |
| 7/1/2045 | | $263,594.25 | $145,538.73 | $118,055.52 | $4,550,592.43 | $263,594.25 |
| 1/1/2046 | $43,115.82 | $263,594.25 | $147,301.33 | $116,292.92 | $4,403,291.10 | $306,710.07 |
| 7/1/2046 | | $263,594.25 | $152,900.40 | $110,693.85 | $4,250,390.70 | $263,594.25 |
| 1/1/2047 | $40,187.05 | $263,594.25 | $154,973.15 | $108,621.10 | $4,095,417.55 | $303,781.30 |
| 7/1/2047 | | $263,594.25 | $160,640.00 | $102,954.25 | $3,934,777.55 | $263,594.25 |
| 1/1/2048 | $37,107.91 | $263,594.25 | $163,038.82 | $100,555.43 | $3,771,738.73 | $300,702.16 |
| 7/1/2048 | | $263,594.25 | $168,253.08 | $95,341.17 | $3,603,485.65 | $263,594.25 |
| 1/1/2049 | $33,970.91 | $263,594.25 | $171,505.17 | $92,089.08 | $3,431,980.48 | $297,565.16 |
| 7/1/2049 | | $263,594.25 | $177,318.07 | $86,276.18 | $3,254,662.41 | $263,594.25 |
| 1/1/2050 | $30,472.69 | $263,594.25 | $180,419.54 | $83,174.71 | $3,074,242.87 | $294,066.94 |
| 7/1/2050 | | $263,594.25 | $186,311.20 | $77,283.05 | $2,887,931.67 | $263,594.25 |
| 1/1/2051 | $26,894.85 | $263,594.25 | $189,791.55 | $73,802.70 | $2,698,140.12 | $290,489.10 |
| 7/1/2051 | | $263,594.25 | $195,766.01 | $67,828.24 | $2,502,374.11 | $263,594.25 |
| 1/1/2052 | $23,133.34 | $263,594.25 | $199,644.69 | $63,949.56 | $2,302,729.42 | $286,727.59 |
| 7/1/2052 | | $263,594.25 | $205,386.37 | $58,207.88 | $2,097,343.05 | $263,594.25 |
| 1/1/2053 | $19,237.19 | $263,594.25 | $209,995.48 | $53,598.77 | $1,887,347.57 | $282,831.44 |
| 7/1/2053 | | $263,594.25 | $216,148.43 | $47,445.82 | $1,671,199.14 | $263,594.25 |
| 1/1/2054 | $15,024.37 | $263,594.25 | $220,885.83 | $42,708.42 | $1,450,313.31 | $278,618.62 |
| 7/1/2054 | | $263,594.25 | $227,134.98 | $36,459.27 | $1,223,178.33 | $263,594.25 |
| 1/1/2055 | $10,653.47 | $263,594.25 | $232,335.25 | $31,259.00 | $990,843.08 | $274,247.72 |
| 7/1/2055 | | $263,594.25 | $238,685.56 | $24,908.69 | $752,157.52 | $263,594.25 |
| 1/1/2056 | $6,058.18 | $263,594.25 | $244,372.45 | $19,221.80 | $507,785.07 | $269,652.43 |
| 7/1/2056 | | $263,594.25 | $250,758.57 | $12,835.68 | $257,026.50 | $263,594.25 |
| 1/1/2057 | $1,234.44 | $263,594.97 | $257,026.50 | $6,568.46 | $0.00 | $264,829.41 |
| **Total** | **$1,792,404.40** | **$18,451,598.22** | **$8,800,852.40** | **$9,650,745.81** | | **$20,244,002.62** |

**Cargill Falls - PT-101841**

**Benefit Assessment Installment Payment Schedule**
**Benefit Assessment Advance + Capitalized Interest = $1,000,000.00**
**Principal: $1,000,000.00; Capitalized Interest: 00.00**
**Interest Rate: 5.00%; Semiannual Installments: 20**
**Project Completion Date: 12/14/2021**

| Payment Date | Payment | Principal Paid | Interest Paid | Remaining Balance |
|---|---|---|---|---|
| - | - | $1,000,000.00 | - | - |
| 1/1/2022 | $2,361.11 | $0.00 | $2,500.00 | $1,000,000.00 |
| 7/1/2022 | $25,277.78 | $0.00 | $25,138.89 | $1,000,000.00 |
| 1/1/2023 | $25,555.56 | $0.00 | $25,555.56 | $1,000,000.00 |
| 7/1/2023 | $25,138.89 | $0.00 | $25,138.89 | $1,000,000.00 |
| 1/1/2024 | $25,555.56 | $0.00 | $25,555.56 | $1,000,000.00 |
| 7/1/2024 | $25,277.78 | $0.00 | $25,277.78 | $1,000,000.00 |
| 1/1/2025 | $25,555.56 | $0.00 | $25,555.56 | $1,000,000.00 |
| 7/1/2025 | $91,249.80 | $66,110.91 | $25,138.89 | $933,889.09 |
| 1/1/2026 | $91,249.80 | $67,383.75 | $23,866.05 | $866,505.34 |
| 7/1/2026 | $91,249.80 | $69,466.82 | $21,782.98 | $797,038.52 |
| 1/1/2027 | $91,249.80 | $70,881.04 | $20,368.76 | $726,157.48 |
| 7/1/2027 | $91,249.80 | $72,995.01 | $18,254.79 | $653,162.47 |
| 1/1/2028 | $91,249.80 | $74,557.87 | $16,691.93 | $578,604.60 |
| 7/1/2028 | $91,249.80 | $76,623.96 | $14,625.84 | $501,980.64 |
| 1/1/2029 | $91,249.80 | $78,421.41 | $12,828.39 | $423,559.23 |
| 7/1/2029 | $91,249.80 | $80,601.99 | $10,647.81 | $342,957.24 |
| 1/1/2030 | $91,249.80 | $82,485.34 | $8,764.46 | $260,471.90 |
| 7/1/2030 | $91,249.80 | $84,701.83 | $6,547.97 | $175,770.07 |
| 1/1/2031 | $91,249.80 | $86,757.90 | $4,491.90 | $89,012.17 |
| 7/1/2031 | $91,249.84 | $89,012.17 | $2,237.67 | $0.00 |
| **Total** | **$1,340,969.68** | **$1,000,000.00** | **$340,969.68** | |

## Exhibit C
## Proposed Lien Schedules – with Modification

**Cargill Falls - PT-100040**

**Benefit Assessment Installment Payment Schedule**
**Benefit Assessment Advance (Project Amount + Closing Fees) + Capitalized Interest = $8,805,203.68**
**Principal: $7,100,000.00; Closing Fees: 00.00; Capitalized Interest: $1,711,116.72**
**Interest Rate: 5.00%; Semiannual Installments: 70**
**Final Disbursement Date: 6/24/2022**

| Payment Date | Lien 1 Special Int PMT, contingently due | Payment | Principal Paid | Interest Paid | Remaining Balance | Total Payment |
|---|---|---|---|---|---|---|
| - | | - | $8,800,852.40 | - | - | |
| 7/1/2022 | | $263,594.25 | $255,037.87 | $8,556.38 | $8,545,814.53 | $263,594.25 |
| 1/1/2023 | contingent | $263,594.25 | $45,201.21 | $218,393.04 | $8,500,613.32 | $263,594.25 |
| 7/1/2023 | | $263,594.25 | $49,898.28 | $213,695.97 | $8,450,715.04 | $263,594.25 |
| 1/1/2024 | contingent | $263,594.25 | $47,631.53 | $215,962.72 | $8,403,083.51 | $263,594.25 |
| 7/1/2024 | | $263,594.25 | $51,182.97 | $212,411.28 | $8,351,900.54 | $263,594.25 |
| 1/1/2025 | contingent | $263,594.25 | $50,156.79 | $213,437.46 | $8,301,743.75 | $263,594.25 |
| 7/1/2025 | | $263,594.25 | $54,897.64 | $208,696.61 | $8,246,846.11 | $263,594.25 |
| 1/1/2026 | contingent | $263,594.25 | $52,841.52 | $210,752.73 | $8,194,004.59 | $263,594.25 |
| 7/1/2026 | | $263,594.25 | $57,606.08 | $205,988.17 | $8,136,398.51 | $263,594.25 |
| 1/1/2027 | contingent | $263,594.25 | $55,664.07 | $207,930.18 | $8,080,734.44 | $263,594.25 |
| 7/1/2027 | | $263,594.25 | $60,453.56 | $203,140.69 | $8,020,280.88 | $263,594.25 |
| 1/1/2028 | contingent | $263,594.25 | $58,631.52 | $204,962.73 | $7,961,649.36 | $263,594.25 |
| 7/1/2028 | | $263,594.25 | $62,341.45 | $201,252.80 | $7,899,307.91 | $263,594.25 |
| 1/1/2029 | contingent | $263,594.25 | $61,723.05 | $201,871.20 | $7,837,584.86 | $263,594.25 |
| 7/1/2029 | | $263,594.25 | $66,566.08 | $197,028.17 | $7,771,018.78 | $263,594.25 |
| 1/1/2030 | contingent | $263,594.25 | $65,001.55 | $198,592.70 | $7,706,017.23 | $263,594.25 |
| 7/1/2030 | | $263,594.25 | $69,873.54 | $193,720.71 | $7,636,143.69 | $263,594.25 |
| 1/1/2031 | contingent | $263,594.25 | $68,448.36 | $195,145.89 | $7,567,695.33 | $263,594.25 |
| 7/1/2031 | | $263,594.25 | $73,350.80 | $190,243.45 | $7,494,344.53 | $263,594.25 |
| 1/1/2032 | contingent | $263,594.25 | $72,072.11 | $191,522.14 | $7,422,272.42 | $263,594.25 |
| 7/1/2032 | | $263,594.25 | $75,975.70 | $187,618.55 | $7,346,296.72 | $263,594.25 |
| 1/1/2033 | contingent | $263,594.25 | $75,855.56 | $187,738.69 | $7,270,441.16 | $263,594.25 |
| 7/1/2033 | | $263,594.25 | $80,823.44 | $182,770.81 | $7,189,617.72 | $263,594.25 |
| 1/1/2034 | contingent | $263,594.25 | $79,859.57 | $183,734.68 | $7,109,758.15 | $263,594.25 |
| 7/1/2034 | | $263,594.25 | $84,862.83 | $178,731.42 | $7,024,895.32 | $263,594.25 |
| 1/1/2035 | contingent | $263,594.25 | $84,069.15 | $179,525.10 | $6,940,826.17 | $263,594.25 |
| 7/1/2035 | | $263,594.25 | $89,109.59 | $174,484.66 | $6,851,716.58 | $263,594.25 |
| 1/1/2036 | contingent | $263,594.25 | $88,494.83 | $175,099.42 | $6,763,221.75 | $263,594.25 |
| 7/1/2036 | | $263,594.25 | $92,635.03 | $170,959.22 | $6,670,586.72 | $263,594.25 |
| 1/1/2037 | contingent | $263,594.25 | $93,123.70 | $170,470.55 | $6,577,463.02 | $263,594.25 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 7/1/2037 | | $263,594.25 | $98,244.14 | $165,350.11 | $6,479,218.88 | $263,594.25 |
| 1/1/2038 | contingent | $263,594.25 | $98,014.21 | $165,580.04 | $6,381,204.67 | $263,594.25 |
| 7/1/2038 | | $263,594.25 | $103,177.85 | $160,416.40 | $6,278,026.82 | $263,594.25 |
| 1/1/2039 | contingent | $263,594.25 | $103,155.79 | $160,438.46 | $6,174,871.03 | $263,594.25 |
| 7/1/2039 | | $263,594.25 | $108,364.85 | $155,229.40 | $6,066,506.18 | $263,594.25 |
| 1/1/2040 | contingent | $263,594.25 | $108,561.31 | $155,032.94 | $5,957,944.87 | $263,594.25 |
| 7/1/2040 | | $263,594.25 | $112,990.64 | $150,603.61 | $5,844,954.23 | $263,594.25 |
| 1/1/2041 | contingent | $263,594.25 | $114,223.20 | $149,371.05 | $5,730,731.03 | $263,594.25 |
| 7/1/2041 | | $263,594.25 | $119,530.04 | $144,064.21 | $5,611,200.99 | $263,594.25 |
| 1/1/2042 | contingent | $263,594.25 | $120,196.89 | $143,397.36 | $5,491,004.10 | $263,594.25 |
| 7/1/2042 | | $263,594.25 | $125,556.51 | $138,037.74 | $5,365,447.59 | $263,594.25 |
| 1/1/2043 | contingent | $263,594.25 | $126,477.26 | $137,116.99 | $5,238,970.33 | $263,594.25 |
| 7/1/2043 | | $263,594.25 | $131,892.36 | $131,701.89 | $5,107,077.97 | $263,594.25 |
| 1/1/2044 | contingent | $263,594.25 | $133,080.04 | $130,514.21 | $4,973,997.93 | $263,594.25 |
| 7/1/2044 | | $263,594.25 | $137,862.64 | $125,731.61 | $4,836,135.29 | $263,594.25 |
| 1/1/2045 | contingent | $263,594.25 | $140,004.13 | $123,590.12 | $4,696,131.16 | $263,594.25 |
| 7/1/2045 | | $263,594.25 | $145,538.73 | $118,055.52 | $4,550,592.43 | $263,594.25 |
| 1/1/2046 | contingent | $263,594.25 | $147,301.33 | $116,292.92 | $4,403,291.10 | $263,594.25 |
| 7/1/2046 | | $263,594.25 | $152,900.40 | $110,693.85 | $4,250,390.70 | $263,594.25 |
| 1/1/2047 | contingent | $263,594.25 | $154,973.15 | $108,621.10 | $4,095,417.55 | $263,594.25 |
| 7/1/2047 | | $263,594.25 | $160,640.00 | $102,954.25 | $3,934,777.55 | $263,594.25 |
| 1/1/2048 | contingent | $263,594.25 | $163,038.82 | $100,555.43 | $3,771,738.73 | $263,594.25 |
| 7/1/2048 | | $263,594.25 | $168,253.08 | $95,341.17 | $3,603,485.65 | $263,594.25 |
| 1/1/2049 | contingent | $263,594.25 | $171,505.17 | $92,089.08 | $3,431,980.48 | $263,594.25 |
| 7/1/2049 | | $263,594.25 | $177,318.07 | $86,276.18 | $3,254,662.41 | $263,594.25 |
| 1/1/2050 | contingent | $263,594.25 | $180,419.54 | $83,174.71 | $3,074,242.87 | $263,594.25 |
| 7/1/2050 | | $263,594.25 | $186,311.20 | $77,283.05 | $2,887,931.67 | $263,594.25 |
| 1/1/2051 | contingent | $263,594.25 | $189,791.55 | $73,802.70 | $2,698,140.12 | $263,594.25 |
| 7/1/2051 | | $263,594.25 | $195,766.01 | $67,828.24 | $2,502,374.11 | $263,594.25 |
| 1/1/2052 | contingent | $263,594.25 | $199,644.69 | $63,949.56 | $2,302,729.42 | $263,594.25 |
| 7/1/2052 | | $263,594.25 | $205,386.37 | $58,207.88 | $2,097,343.05 | $263,594.25 |
| 1/1/2053 | contingent | $263,594.25 | $209,995.48 | $53,598.77 | $1,887,347.57 | $263,594.25 |
| 7/1/2053 | | $263,594.25 | $216,148.43 | $47,445.82 | $1,671,199.14 | $263,594.25 |
| 1/1/2054 | contingent | $263,594.25 | $220,885.83 | $42,708.42 | $1,450,313.31 | $263,594.25 |
| 7/1/2054 | | $263,594.25 | $227,134.98 | $36,459.27 | $1,223,178.33 | $263,594.25 |
| 1/1/2055 | contingent | $263,594.25 | $232,335.25 | $31,259.00 | $990,843.08 | $263,594.25 |
| 7/1/2055 | | $263,594.25 | $238,685.56 | $24,908.69 | $752,157.52 | $263,594.25 |
| 1/1/2056 | contingent | $263,594.25 | $244,372.45 | $19,221.80 | $507,785.07 | $263,594.25 |
| 7/1/2056 | | $263,594.25 | $250,758.57 | $12,835.68 | $257,026.50 | $263,594.25 |
| 1/1/2057 | contingent | $263,594.97 | $257,026.50 | $6,568.46 | $0.00 | $263,594.97 |
| **Total** | **$0.00** | **$18,451,598.22** | **$8,800,852.40** | **$9,650,745.81** | | **$18,451,598.22** |

**Cargill Falls - PT-101841**

**Benefit Assessment Installment Payment Schedule**
**Benefit Assessment Advance (Project Amount + Closing Fees) + Capitalized Interest = $1,255,037.87**
**Principal: $$1,255,037.87; Capitalized Interest: 00.00**
**Interest Rate: 5.00%; Semiannual Installments: 20**
**Project Completion Date: 12/14/2021**

| Payment Date | Payment | Principal Paid | Interest Paid | Remaining Balance |
|---|---|---|---|---|
| - | - | - | - | - |
| 1/1/2022 | $2,361.11 | $0.00 | $2,500.00 | $1,000,000.00 |
| 7/1/2022 | $25,277.78 | ($255,037.87) | $25,138.89 | $1,255,037.87 |
| 1/1/2023 | $32,073.19 | ($210,875.40) | $32,073.19 | $1,465,913.27 |
| 7/1/2023 | $36,851.43 | ($210,875.40) | $36,851.43 | $1,676,788.67 |
| 1/1/2024 | $42,851.27 | ($210,875.40) | $42,851.27 | $1,887,664.07 |
| 7/1/2024 | $47,715.95 | ($210,875.40) | $47,715.95 | $2,098,539.47 |
| 1/1/2025 | $53,629.34 | $0.00 | $53,629.34 | $2,098,539.47 |
| 7/1/2025 | $121,530.61 | $68,775.66 | $52,754.95 | $2,029,763.81 |
| 1/1/2026 | $121,530.61 | $69,658.87 | $51,871.74 | $1,960,104.93 |
| 7/1/2026 | $121,530.61 | $72,255.75 | $49,274.86 | $1,887,849.18 |
| 1/1/2027 | $121,530.61 | $73,285.58 | $48,245.03 | $1,814,563.59 |
| 7/1/2027 | $121,530.61 | $75,914.50 | $45,616.11 | $1,738,649.09 |
| 1/1/2028 | $121,530.61 | $77,098.47 | $44,432.14 | $1,661,550.62 |
| 7/1/2028 | $121,530.61 | $79,530.30 | $42,000.31 | $1,582,020.31 |
| 1/1/2029 | $121,530.61 | $81,101.20 | $40,429.41 | $1,500,919.11 |
| 7/1/2029 | $121,530.61 | $83,799.17 | $37,731.44 | $1,417,119.93 |
| 1/1/2030 | $121,530.61 | $85,315.32 | $36,215.29 | $1,331,804.61 |
| 7/1/2030 | $121,530.61 | $88,050.52 | $33,480.09 | $1,243,754.09 |
| 1/1/2031 | $121,530.61 | $89,745.78 | $31,784.83 | $1,154,008.30 |
| 7/1/2031 | $121,530.61 | $92,520.12 | $29,010.49 | $1,061,488.18 |
| 1/1/2032 | $121,530.61 | $94,403.69 | $27,126.92 | $967,084.49 |
| 7/1/2032 | $121,530.61 | $97,084.86 | $24,445.75 | $869,999.62 |
| 1/1/2033 | $121,530.61 | $99,297.29 | $22,233.32 | $770,702.33 |
| 7/1/2033 | $121,530.61 | $102,156.01 | $19,374.60 | $668,546.31 |
| 1/1/2034 | $121,530.61 | $104,445.54 | $17,085.07 | $564,100.77 |
| 7/1/2034 | $121,530.61 | $107,349.74 | $14,180.87 | $456,751.03 |
| 1/1/2035 | $121,530.61 | $109,858.08 | $11,672.53 | $346,892.94 |
| 7/1/2035 | $121,530.61 | $112,810.11 | $8,720.50 | $234,082.83 |
| 1/1/2036 | $121,530.61 | $115,548.49 | $5,982.12 | $118,534.33 |
| 7/1/2036 | $121,530.61 | $118,534.33 | $2,996.28 | $0.00 |
| **Total** | **$3,035,964.19** | **$1,000,000.00** | **$937,424.72** | **$36,862,773.22** |

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CONNECTICUT GREEN BANK

# Memo

**To:** Connecticut Green Bank Board of Directors

**From:** Eric Shrago (Vice President of Operations)

**Date:** January 13, 2023

**Re:** Electric Vehicle Carbon Credit Pilot Program Trade Process Authorization

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## I. Overview

The Green Bank is enabled through CGS Sec. 16-245n (as amended by Public Act 21-115) to engage carbon offset markets using its "environmental infrastructure" authorization,[1] and also through its "clean energy"[2] authorization as applicable. Voluntary market carbon offsets (hereafter "offsets") are tradable instruments embodying one ton of carbon dioxide avoided or reduced, as certified by credible and recognized sources. There are actually two general markets for offsets: 1) government-backed "compliance" markets (e.g., CA LCFS, OR CFS) where regulated entities must buy credits; and 2) voluntary markets, representing bilateral, free-market transactions whereby a broker or typically corporate off-taker seeks to acquire an offset so as to make a claim of emissions avoidance (which would require cancelling or retiring the offset).

High-quality and credible carbon offsets are created under administrative bodies that operate developed certification protocols, determining the emissions reduction activity, scope, verifiability, and measurement procedures. At present, the Green Bank has one offsets project, using methodology VM0038[3] and VMD0049[4] published under the Verified Carbon Standard ("VCS") Program[i], administered by the nonprofit Verra. This methodology allows those with the rights to electric vehicle charging infrastructure to earn carbon credits based on vehicle charging activity. This project is a third-party aggregation, with the Green Bank as the sole project proponent, and all partners assigning to the Green Bank the rights and title to the environmental attributes of electric vehicle ("EV") charging transactions, so that the

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[1] Per Public Act 21-115, "environmental infrastructure" means "…and (G) environmental markets, including, but not limited to, carbon offsets and ecosystem services." "Carbon offsets, means any activity that compensates for the emission or carbon dioxide or other greenhouse gases by providing for an emission reduction elsewhere."

[2] Per CGS 16-245n, "clean energy" includes "…projects that seek to deploy electric, electric hybrid, natural gas or alternative fuel vehicles and associated infrastructure…"

[3] https://verra.org/methodologies/vm0038-methodology-for-electric-vehicle-charging-systems-v1-0/

[4] https://verra.org/methodologies/vmd0049-activity-method-for-determining-additionality-of-electric-vehicle-charging-systems-v1-0/

associated data sets may be converted into carbon offsets to make verifiable, permanent and liquid (tradable) claims of emissions avoidance. The Green Bank led the development of this methodology with several partners going back to 2016 and worked with a consortium of partners[5] to submit for credits in 2021 for activity from 2016-2021.[6] Credits were certified, verified, and minted in the fall of 2022.

Now we are seeking to monetize these credits on behalf of the consortium.

## II. Credit Sales Process

Step 1. Verify quantities, fees, and delivery

The first step that the Green Bank will take is to confirm the quantity of credits due to each partner after the Green Bank's fees and any referral fees are charged and to confirm delivery instructions (i.e., that the partner wishes to take cash or credits and where).

Step 2. Consult market

Throughout the year, while the credits are being minted (reviewed and created by Verra), Green Bank staff will maintain relationships with brokers, offset buyers, and portfolio managers to ensure that they are up to date with regard to the direction of the market. The voluntary carbon markets are very much relationship based at this time and counterparties often desire to understand the intricate details of projects to ensure their comfort that carbon abatement is actually occurring.

When it comes time to sell the credits, Green Bank staff will obtain whenever possible, no fewer than three prices from external brokers and/or counterparties for interest in the credits. It is expected that, to meet the needs of all the partners and to maintain relationships in this market, multiple counterparties will be selected for the sales.

Step 3. Review and approval

Once staff have received at least three offers, the officers of the Green Bank, along with the Executive Vice President of Finance and Accounting, and the Vice President of Operations must approve of the transactions to be executed. And upon such approval, staff will enter into agreements with the counterparties for said sales.

Step 4. Summary

At the end of every monetization cycle (annually), staff will memorialize the details of that year's carbon offset aggregation and sales activity in a memorandum.

[5] Partners include: AmpUp, Blink Dominion Energy, EV Match, EV Structure, Exelon, Opconnect, OptiWatt, and UGO. We have been facilitated by the expertise brought by the Climate Neutral Business Network.

[6] https://verra.org/new-methodology-for-ev-charging-systems-approved/

## III. Revisit Process

This process represents the nascence of the carbon markets and the Green Bank's engagement through this program. Given that the Green Bank has approximately 5200 carbon offsets for sale, at a price between [$10] and [$14], it is estimated that gross proceeds of the sales this year are to be less than $65,000 but with rapid growth in the next few years. Staff commits to an ongoing review of this process and to bring this process back to the Board of Directors for their review by within the next two years.

## IV. Resolution

**WHEREAS,** CGS Sec. 16-245n (as amended by Public Act 21-115) empowers the Connecticut Green Bank to leverage the carbon offset markets to monetize environmental attributes that accelerate the deployment of clean energy;

**WHEREAS,** the Green Bank has led the creation of a methodology with the Verified Carbon Standard to monetize electric vehicle charging activity and is the leader of a consortium that has earned credits under this methodology;

**Now, be it**

**RESOLVED,** the Board of Directors of the Connecticut Green Bank direct staff to sell the credits aggregated as part of this project using the aforementioned process and to update the Board as to this process by 2025.

[i] The VCS Program is the world's most widely used greenhouse gas (GHG) crediting program.

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CONNECTICUT
GREEN BANK

# Memo

**To:** Connecticut Green Bank Board of Directors

**From:** Mackey Dykes, Vice President, Financing Programs, Alex Kovtunenko, Associate General Counsel, and Alysse Lembo-Buzzelli, Associate Director, Financing Programs

**Date:** January 20, 2023

**Re:** C-PACE SIR Policy Revision Introduction

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## Overview

Conn. Gen. Stat. Section 16a-40g authorizes what has come to be known as the Commercial Property Assessed Clean Energy Program ("C-PACE"), designates the Connecticut Green Bank ("CGB") as the state-wide administrator of the program and charges CGB to "develop program guidelines governing the terms and conditions under which state and third-party financing may be made available to the commercial sustainable energy program." Since 2013, CGB has developed and maintained the "Program Guidelines" for the C-PACE program in accordance with this statutory requirement.

CGB Staff is presenting a revision to the C-PACE Savings-to-Investment Ratio (SIR) Policy to the Board for discussion purposes only. The revision would consist of still requiring the SIR calculation itself, but removing the necessity for the SIR to be greater than 1 for certain technologies. Those technologies are identified as high-efficiency electrification technologies with no fossil fuels. This change would require requesting a change to the C-PACE statute by the Connecticut General Assembly and the Governor before any revisions are made to the Program Guidelines.

## C-PACE Financing difficulties for certain energy efficiency improvements

Since the C-PACE program's inception, Staff has experienced difficulty financing certain energy efficiency projects (i.e., HVAC and mechanical improvements, as well as electrification improvements such as heat pumps) due to the requirement of having a positive SIR (SIR of 1 or greater). Failure to meet the SIR requirement has resulted in 1) not financing the energy efficiency project at all, or 2) financing a portion of the project by reducing the amount financed (investment or "I") to meet the projected savings (savings or "S"). Due to this limitation, Staff believes that

there are many quality projects that meet both the CGB's mission and State energy policy goals that are not being completed, due to lack of access to capital.

## Policy Revision Suggestion

In order to give borrowers, contractors, and capital providers a more accessible way to use C-PACE financing for certain electrification energy efficiency projects while still preserving the program's integrity, Staff recommends exploring an SIR policy revision. Projects that include energy conservation measures that align with State electrification goals, such as high-efficiency electric HVAC equipment (more efficient than code), heat pump water heaters, and replacement of delivered fuels with high-efficiency electric alternatives, often do not meet the SIR>1 requirement, and therefore would benefit from the following policy revision:

- Continue to require the SIR evaluation- which consists of an energy audit completed by the contractor, followed by a third-party review of the savings- but remove the requirement for the SIR to be greater than 1. With this revision,
    1. Energy and dollar savings are still being calculated through the required audit
    2. The energy and dollar savings will be presented to the Property Owner with the intention of making them aware of the cash flows, along with the requirement of a signature acknowledging they understand the SIR
- As a capital provider, CGB will continue to underwrite projects in the same manner, with all Loan-to-Value, Lien-to-Value and Debt Service Coverage Ratio requirements remaining the same
- All other C-PACE programmatic requirements, including lender consent, will remain as they are – meaning, a lender still has the right to not consent to the C-PACE benefit assessment being placed on the property if they don't support an SIR of less than 1 for such equipment

## Benefits and Challenges

BENEFITS

Possible benefits that could result by removing the requirement of an SIR>1 are identified as follows:

- Incentivizes property owners to explore electrification measures through low-cost, long-term financing
- Increases the number of electrification projects in the state, which is consistent with the state's public policies on reducing greenhouse gas emissions
- Provides property owners with necessary information regarding the performance of the proposed measures, but allows them to make decisions based on other positive project aspects besides cash flow
- Increases the number of financeable projects through C-PACE, theoretically resulting in higher numbers of closed projects for both third-party capital providers and CGB

CHALLENGES

Possible challenges that could arise by removing the requirement of an SIR>1 are identified as follows:

- Lender consent without positive cash flow may be difficult (although there are other commercial PACE jurisdictions that do not have SIR requirements where consents have been received)
- Savings from projects will not be greater than the C-PACE repayments, potentially increasing the risk of default
- Financial underwriting for projects without the added benefit of positive cash flow could be challenging
- Creates an extra 'step' in the process to ensure a property owner has reviewed the cash flow analysis and understands how the project is projected to perform, from a financial perspective.

## Recommendation

Staff recommends that the Green Bank Board (the "Board") authorize staff to pursue a statutory change of the SIR policy to make financing certain electrification energy efficiency projects more accessible through C-PACE in accordance with this memorandum and welcomes all feedback.

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CONNECTICUT GREEN BANK

# Memo

**To:** Connecticut Green Bank Board of Directors

**From:** Bert Hunter, EVP & CIO; Louise Della Pesca, Consultant, Clean Energy Finance

**CC:** Bryan Garcia, President & CEO; Mackey Dykes, VP, Financing Programs; Brian Farnen, General Counsel & CLO

**Date:** January 13, 2022

**Re:** Connecticut Green Bank Commercial Solar Program Modification

---

## Purpose

The purpose of this memo is to request approval to expand the existing Connecticut Green Bank Commercial Solar Program ("CGB Commercial Solar Program" or the "Program") to incorporate financing property owned commercial solar PV systems where CGB is unable to put in place a Commercial Property Assessed Clean Energy ("C-PACE") benefit assessment lien.

## Background and Context

The CGB Commercial Solar Program has operated successfully since 2015 and, following multiple approvals by CGB Board of Directors (the "Board"), evolved into a multi-faceted financing program. Specifically, the Program has deployed capital in the form of:

1. **Equity:** own and operate two commercial solar funds (CT Solar Lease 2 LLC and CT Solar Lease 3 LLC) alongside tax equity partner US Bank;

2. **Development financing:** develop new commercial solar projects that are sold to third parties in return for a development fee. Example counterparties include Onyx Renewable Partners, Sunwealth, Skyview Ventures and Inclusive Prosperity Capital; and

3. **Construction and term financing:** provide capital to third parties during the construction and operational phases of commercial solar projects. Example counterparties include Sunwealth, Skyview Ventures and Inclusive Prosperity Capital.

A detailed history of the CGB Commercial Solar Program is provided in Appendix 1 to this memorandum. This Appendix comprises the original Program Qualification Memo of the Program dated October 2018 and subsequently updated and approved by the Board in July

2019 and March 2020. In the most recent update to the Program, the Board approved the allocation of $30 million funding for:

1. Development capital;
2. Construction financing;
3. Financing one or more 3rd-party ownership platforms, in the form of sponsor equity and/or debt; and
4. Selling solar PPA projects developed by CEFIA Holdings LLC, the CGB subsidiary that acts as a development company, to third parties.

This memorandum requests an addition to the use of the allocated funding so that CGB may finance property owned commercial solar PV systems where CGB is unable to put in place a C-PACE benefit assessment lien. Target entity types for this funding include condominium associations, non-profits and municipalities.

## Market Need for Expansion of CGB Commercial Solar Program

As the commercial solar market in Connecticut has matured, commercial entities now have various options to benefit from the installation of a solar PV system. The first decision point is whether to own and operate the solar PV system, or to host it on the commercial entity's property while a third party owns and operates the system. When choosing the former option, CGB and other capital providers operating in Connecticut offer C-PACE financing. Through the Inflation Reduction Act ("IRA") non-profit organizations are now eligible to receive Direct Pay for the Investment Tax Credit ("ITC") and some non-profits and municipalities also have an interest in owning solar PV systems.

In some cases however, it is not possible to secure the financing with a C-PACE benefit assessment lien. This could be because the commercial entity's mortgage holder will not subordinate to the C-PACE lien, or because the ownership structure of the commercial property precludes putting a C-PACE lien in place (for example, condominium properties). There is a market for a product that provides commercial entities (including non-profits and municipalities) that cannot access C-PACE financing, but nevertheless wish to own and operate a solar PV system, with a financing option.

## Business Opportunity for Expansion of CGB Commercial Solar Program

According to the Connecticut Community Associations Institute, over 20% of the state's population lives in a common interest community[1]. In 2022 alone, the US Small Business Administration's Connecticut District Office distributed over $300M in loans to small businesses through commercial lenders and community partners, which included over 100 '504 loan program' loans[2]. These are pertinent examples because a commercial entity set up as a condominium association, or in receipt of a '504 loan' from the Small Business Administration, would typically not be able to access C-PACE financing.

[1] Community Associations Institute website - link
[2] CBIA website - link

The policy environment for commercial solar in Connecticut has helped create the opportunity for a new non C-PACE financing product. The Non-Residential Renewable Energy Solutions program ("NRES") replaced the LREC/ZREC program in 2022 and offers participants a new way to monetize a commercial solar PV system. Under the NRES program, a participant may bid for a Buy-All Sell-All ("BASA") tariff, known more widely in the industry as a feed-in tariff. With a BASA tariff, a commercial solar PV system owner is compensated at a fixed rate for each kilowatt-hour of energy produced over a 20 year term, and the counterparty is one of the two investor-owned, investment grade utilities in Connecticut. Further, the system owner can opt to redirect a portion / all of the BASA tariff revenue to a third party, so that the funds flow directly from the utility to the third party.

The NRES program presents an opportunity for a finance provider to make a loan to the owner of a commercial solar PV system and be repaid from tariff BASA tariff revenue earned by the system, with payments coming direct to the finance provider from the utility on a quarterly basis. Staff requests Board approval to structure such a financing product and add it to the options for capital deployment under the CGB Commercial Solar Program.

## Parameters for Financing 3rd-Party Owned Solar PV Systems

Capital deployed under this construct would be subject to the following terms, which are aligned with the existing financing parameters of the CGB Commercial Solar Program (see Appendix 1):

- **Investment Type**: Debt
- **Investment Return Profile**: An investment IRR not less than Green Bank return requirements across comparable investments (e.g., a C-PACE equivalent note yielding at least a C-PACE equivalent rate, or higher to account for the absence of a C-PACE benefit assessment lien);
- **Investment Risk Profile:** Underlying security, cashflow coverage, collateral, or otherwise equivalent to Green Bank risk requirements across comparable investments (see further details below);
- **Investment Amount:** Anticipated to constitute no less than $0.5 million of the total not-to-exceed amount of $30 million in new money authorized by the Board in March 2020, subject to budget constraints.
- **Investment Approval:** Investments below $0.5 million would be subject to Staff level approval, investments between $0.5 million and $2.5 million would be subject to approval by Deployment Committee and investments greater than $2.5 million would be approved by the Board.
- **Counterparty Selection:** Recipients of CGB capital would be subject to underwriting equivalent to comparable CGB product (e.g., C-PACE financing)

In the absence of a C-PACE benefit assessment lien, the financing would be subject to the following risk management requirements:

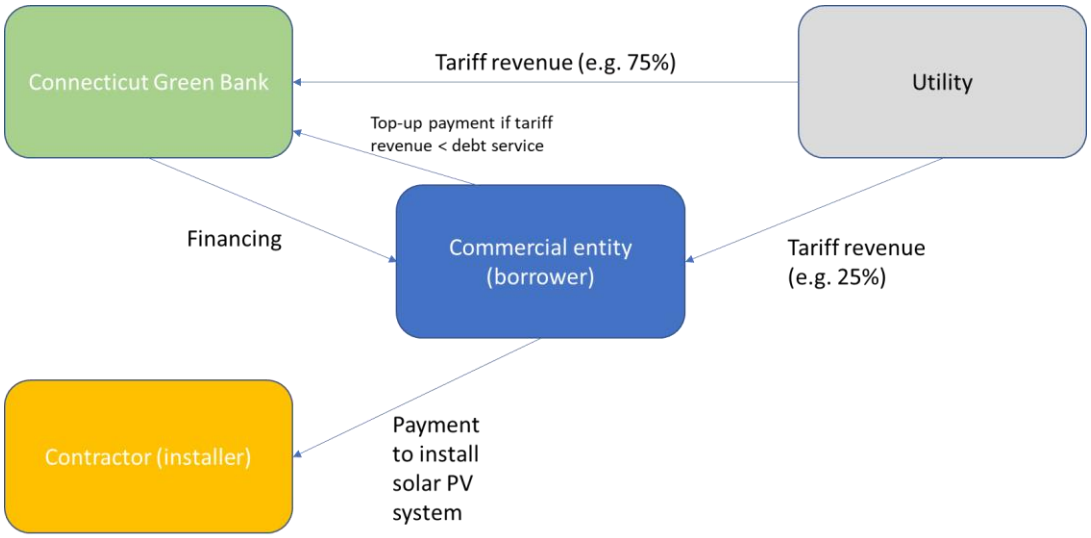
- Minimum debt service coverage ratio of 1.2x

- First priority lien on solar PV equipment
- Assignment of tariff revenue in an amount that is forecast to cover the debt service payments for the term of the financing
- Site control mechanism, such as a springing site lease, so that in the event of borrower default CGB may take over operations of the solar PV system
- Covenant to increase the assignment of tariff revenue to 100%, in the event of borrower default

## Green Bank Participation and Financial Benefit

### Structure Diagram

The diagram below depicts an example financing arrangement for a non C-PACE secured commercial solar loan.




### Ratepayer Payback

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

Hypothetical project:

- Size: 200kW
- CGB financing: $300,000
- kWh generated over 25 project life: 5,000,000 kWh
- kWh / ratepayer funds at risk: 16.7

### Financial Statements

*How is the program investment accounted for on the balance sheet and profit and loss statements?*

The capital deployed by the Green Bank as authorized herein will result in a decrease in Unrestricted Cash on the Green Bank's balance sheet and, depending on the use of funds, an equivalent increase in short- and long-term promissory notes receivable.

### Risk to Ratepayer Funds

*What is the maximum risk exposure of ratepayer funds for the program?*

The maximum risk exposure of ratepayer funds for the CGB Commercial Solar program is a not-to-exceed amount of $30 million (subject to budget constraints), which may be development capital, construction or term debt capital to a 3rd-party solar project owner, or sponsor equity for a retained project. This memorandum does not seek an increase to the ratepayer funds for the Program, rather an expansion of the financing products considered under 'construction or term debt capital to a 3rd-party solar project owner'.

### Target Market

*Who are the end-users of the engagement?*

Commercial entities, including condominium associations, within the state of Connecticut that might otherwise struggle to access financing (such as C-PACE financing) to own solar PV systems. Municipal entities, that are also not able to access C-PACE financing, may also be interested in this product.

## Program Risks and Mitigation Strategies

The risks of structuring a commercial solar financing product are well understood by CGB given our deep experience operating in the market in both debt- and equity-holder roles.

### Market and Origination Risk:

Risks:

- Changes to tariff rates offered by utilities mean the market may not be able to support cost of installation plus required return on investment for CGB financing
- Public policy changes (e.g., from tariff to some as yet undefined alternative) that have an adverse impact monetization of solar PV systems
- CGB is unable to originate enough qualified projects to meet targets

Mitigation Strategy:

- Advocating appropriate tariff rates before PURA for behind the meter solar PV that balance ratepayer impact with end-use customer return on investment / savings
- Tariff terms are 20 years and are governed by contractual arrangements with utilities. Though the public policy (NRES) may change in future, such a change would not be expected to result in default by the utilities on executed tariff contracts

- Leverage of the reputation and reach of CGB's existing programs, such as C-PACE, to identify route to market for this product

### Structural risk:

Risks:

- Parties to the tariff agreement are the customer of record (i.e., borrower) and utility. In event of borrower default, CGB does not become customer of record and utility's counterparty in tariff agreement. Instead, CGB is reliant on borrower to agree to assign tariff revenue to CGB in its entirety in order for CGB to continue receiving funds and recover its investment.

Mitigation Strategy:

- Financing agreements will incorporate the requirement for borrower to assign tariff revenue to CGB in event of borrower default
- CGB to advocate for an improvement to the NRES program rules in this regard (this is an issue that industry has already identified as requiring amelioration).

### Credit Risk:

Risk:

- Borrower defaults on loan and fails to make repayments

Mitigation Strategy:

- Well delineated credit requirements for borrowers in line with well established CGB programs, such as C-PACE
- Amongst other potential credit enhancements, use sculpted amortization of debt including balloon payments timed to coincide with receipt of tax credit

### System Performance Risk:

Risk:

- Solar PV systems financed by CGB do not meet production expectations, the value proposition to commercial entities will decline, reducing energy savings

Mitigation Strategy:

- Contractor approval requirements, following existing CGB programs such as C-PACE, ensuring contractors have adequate experience, insurance, and finances to undertake project in a safe and effective manner, as well as ongoing oversight
- Enhanced commissioning protocols, for example involving an independent engineer inspection

- Potential to use a list of approved technologies, actively maintained/updated ensuring that technologies used are the most efficient, cost effective, and that manufacturers with the highest likelihood of being able to stand by their warranties are used
- Diligence process based on existing process used for CGB-developed projects

### Development Risk:

Risk:

- Projects in construction fail to reach completion

Mitigation Strategy:

- Continuation of existing Green Bank best practices with respect to contractor approval and oversight, and milestone payment structure in construction agreements
- Pre-construction diligence to ensure that projects are economically viable with realistic chance of providing expected return on investment to all stakeholders, and to any stakeholder that would step into the project if necessary to help it reach completion

## Resolutions

**WHEREAS**, the Connecticut Green Bank ("Green Bank") Board of Directors (the "Board") passed resolutions at its March 25, 2020 meeting to approve funding, in a total not-to-exceed amount of $30 million in new money, subject to budget constraints, for the continued development by Green Bank, and financing of development by 3rd parties, of commercial-scale solar PV projects, to be utilized for the following purposes pursuant to market conditions and opportunities:

1. Development capital;
2. Construction financing;
3. Financing one or more 3rd-party ownership platforms, in the form of sponsor equity and/or debt; and
4. Sell solar PPA projects developed by Holdings to third parties.

**WHEREAS**, the Green Bank is uniquely positioned to continue developing a commercial solar project pipeline through local contractors in response to continued demand;

**WHEREAS**, the market for commercial solar financing continues to evolve, as public policy changes create opportunities for financing innovation;

**WHEREAS**, there is still demonstrated need for flexible capital to continue expanding access to financing for commercial-scale customers looking to access solar, while both bolstering project returns for investors and enhancing project savings profiles for customers, including for property owned non-profit and commercial solar PV systems where it is not possible to place a Commercial Property Assessed Clean Energy benefit assessment lien as security, subject to appropriate credit assessment by Green Bank staff of the third party owner as explained in a memorandum submitted to the Green Bank Board of Directors (the "Board") dated January 13, 2023 (the "Board Memo"); and

**WHEREAS**, the Green Bank is implementing a Sustainability Plan that invests in various clean energy projects and products to generate a return to support its sustainability in the coming years.

**NOW**, therefore be it:

**RESOLVED,** that the Board approves financing of third party owned commercial solar PV systems where it is not possible to place a Commercial Property Assessed Clean Energy benefit assessment lien as security, subject to appropriate credit assessment of the third party owner as explained in the Board Memo;

**RESOLVED**, that the President of Green Bank; and any other duly authorized officer of Green Bank, is authorized to execute and deliver, any contract or other legal instrument necessary to continue to develop and finance commercial projects on such terms and conditions as are materially consistent with the Board Memo; and

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

Submitted by: Bryan Garcia, President and CEO; Bert Hunter, EVP and CIO; Louise Della Pesca, Consultant, Clean Energy Finance

## Appendix 1 – Original Program Qualification Memo for Connecticut Green Bank Solar PPA Program

# Connecticut Green Bank Solar PPA Program Updates

Revised Due Diligence Package

March 18, 2020 (originally circulated: October 19, 2018, first revised July 9, 2019)

**Document Purpose:** This document contains background information and due diligence on the Connecticut Green Bank Solar PPA Program, in partnership with Inclusive Prosperity Capital, Inc. and other potential PPA sponsors through financing arrangements described herein. This information is provided to the Connecticut Green Bank Board of Directors for the purposes of reviewing and approving recommendations made by the staff of the Connecticut Green Bank.

In some cases, this package may contain among other things, trade secrets, and commercial or financial information given to the Connecticut Green Bank in confidence and should be excluded under C.G.S. §1-210(b) and §16-245n(D) from any public discourse under the Connecticut Freedom of Information Act. If such information is included in this package, it will be noted as confidential.

# Program Qualification Memo

| | |
|---|---|
| **To:** | Connecticut Green Bank Board of Directors |
| **From:** | Bert Hunter, EVP & CIO; Mariana Cardenas, Consultant, Clean Energy Finance; Louise Della Pesca, Associate Director, Clean Energy Finance; |
| **Cc:** | Bryan Garcia, President & CEO; Mackey Dykes, VP, C I &I; Brian Farnen, General Counsel |
| **Date:** | March 18, 2020 (originally circulated October 19, 2018, first revised July 9, 2019) |
| **Re:** | Connecticut Green Bank Solar PPA Program Updates |

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## Purpose

The purpose of this memo is to request approval from the Connecticut Green Bank ("Green Bank") Board of Directors (the "Board") to confirm the authority of the Green Bank to participate in various financing and development roles with respect to commercial solar photovoltaic ("PV") PPA projects within Connecticut – specifically, roles that the Green Bank has played at various times in the past and now would like to continue to operate across, and further expand on, for the benefit of both the Green Bank and the Connecticut market. In the past few years, as the commercial solar sector has evolved more generally, there have been new entrants into the commercial solar market in Connecticut who can contribute to financing and developing projects, including – just for the most "close to home" example – the Green Bank's recent spin-out entity Inclusive Prosperity Capital, Inc. ("IPC"). IPC in turn, by means of its own growth strategy and partnership formations, is attracting additional financing and development players into Connecticut, such as Sunwealth Power, Inc. ("Sunwealth"), a Massachusetts-based commercial solar developer who can bring development capital, term financing, and tax equity to a diverse array of small projects with unconventional credit profiles[3].

As the market develops and benefits from new players who add liquidity, expertise, and options for customers, the role of the Green Bank necessarily changes away from (a.) having to be a foundational player that sets and communicates out a specific financing structure in order to move projects forward and towards (b.) being a "bridge" player that leverages ratepayer capital through multiple structures and platforms in order to continue to drive access to capital and cost savings to customers, as the market builds momentum and scales towards fully private capital solutions. Importantly, the Green Bank continues to develop a strong pipeline of commercial solar PPA projects in this evolving market, due to institutional knowledge derived over time, as well as a network of relationships with developers, customers, and key local players who facilitate project origination.

With the ability to determine, based on project fundamentals, partner strengths, and market conditions, how the Green Bank ultimately participates in specific projects and fund structures (e.g. whether via (i.) providing development and construction capital, (ii.) providing term

[3] https://www.sunwealth.com/

financing in the form of either debt or equity to projects that are developed by CEFIA Holdings LLC ("Holdings") and sold to a 3rd party platform (e.g. IPC or Sunwealth), or (iii.) providing construction and term financing to projects that are developed by 3rd parties in Connecticut only), the Green Bank can optimize the use of ratepayer funds for leveraging private capital and developing quality projects to benefit local communities.

Staff is thus seeking approval to continue to develop and sell commercial solar PV PPA projects in Connecticut developed by Holdings, and to provide construction and term financing to projects developed by 3rd parties, and deploy capital in amounts in line with annual budgetary and financial planning limits but with an overall not-to-exceed amount across development, sponsor equity, and debt investments of up to $30 million (originally approved in October 2018 at $15 million), in form and structure in line with financing roles that the Green Bank has played in the past – specifically:

1. Development capital;
2. Construction financing;
3. Financing a 3rd party ownership platform (e.g. IPC or Sunwealth), in the form of sponsor equity and/or debt.

The participation and financing scenarios above give rise to various value streams and benefits to the Green Bank – for example, providing development capital to a project that is then purchased by a 3rd-party ownership platform gives the Green Bank an upfront income/liquidity boost, whereas providing term equity or debt provides a stream of cash flows over time. The following sections herein further detail those considerations, in addition to outlining parameters within which Green Bank staff will operate when determining how best to deploy capital for commercial solar PV projects in Connecticut.

## Background and Context

The Green Bank has successfully run two commercial solar PPA funds, CT Solar Lease 2 LLC ("SL2") and CT Solar Lease 3 LLC ("SL3"), through which the Green Bank previously developed and now continues to own and operate projects via an ownership platform that was capitalized by a combination of ratepayer funds and 3rd-party capital providers. Subsequently, the Green Bank entered into a sourcing and servicing arrangement with Onyx Renewable Partners ("Onyx"), under which the Green Bank has developed projects and then sold those projects into an Onyx-owned ownership platform. Moving forward from the self-sponsored solar funds and then to a strategically aligned partnership with a third party fund (i.e., Onyx), the Green Bank expanded its development reach to include on an opportunistic basis a development-deployment program whereby the Green Bank continued to work with contractors within the state to originate and develop projects which the Green Bank would then sell into the market. The following table summarizes the number and capacity of projects deployed into each of those fund structures, along with projects that are currently in development with the Green Bank but not yet designated for a final financing structure:

| | # of Projects | Total Capacity (MW) |
|---|---|---|

| | | |
|---|---|---|
| SL2 (Green Bank owned) | 53 | 9.70 |
| SL3 (Green Bank owned) | 31 | 5.75 |
| Onyx | 14 | 9.41 |
| Developed and sold | 20 | 3.1 |
| Currently in development | 13 | 4.9 |

With the addition of new entrants and evolving market dynamics, as summarized in the "Purpose" section above, projects currently in development represent strategic assets that the Green Bank can monetize via different financing structures and ownership vehicles as the Green Bank deems to be in the best interest of both the Green Bank itself and the broader market, as dictated by project fundamentals, partner strengths, and market conditions. The ability to monetize projects without the restrictions of a single financing structure means that the Green Bank can continue to develop a pipeline of projects, to the benefit of both the Green Bank and the development / financing ecosystem that we are working to support. It should also be noted that as the commercial solar PV market transitions from a net metering and ZREC-LREC incentive policy, that the Green Bank having a financing product in place will assist the market in its transition to a tariff-based structure and to foster the sustained, orderly development of a state-based solar industry.

From both the customer and project origination perspective, given the Green Bank's strong presence in the Connecticut commercial-scale solar market, it makes sense for the Green Bank to continue to originate commercial PPA projects in partnership with our existing, local developer base, as well as new market entrants attracted by the Green Bank's ability to accelerate growth in this market. This "distributed" partnership approach, with local developers at the top of the funnel, larger developers and financiers at the bottom of the funnel, and the Green Bank intermediating in the middle, results in both localized economic development and – via competition – better terms for customers resulting in enhanced access to capital and lower energy costs.

## Parameters for Financing 3rd-Party Ownership Platforms

Green Bank staff requests approval for the Green Bank to provide construction and term financing to support Connecticut projects developed and sold by Holdings under 3rd-party owned financing structures, and to support Connecticut projects developed by 3rd parties. An example would be the Green Bank providing term debt into a fund structure where that Green Bank debt sits alongside (or as back-leverage to) 3rd-party sponsor equity, 3rd-party tax equity, and potentially other 3rd-party debt in a financing vehicle that is owned by a 3rd-party (e.g. IPC or Sunwealth).

Green Bank staff has expertise in developing PPA projects, selling them to third party owners and subsequently structuring term financing, as it is the type of investment that the Green Bank has done before (most specifically via the term debt authority embedded in our Onyx

Agreement, further discussed below), and the Green Bank's position in this role represents a stepping stone in further market evolution towards fully private capital solutions (i.e. the market has evolved to the point where 3rd-party sponsors are willing to develop and own the types of underserved and unconventional credits typically served by the Green Bank, but the fund-level economics still need a boost from the Green Bank, in the form of term debt for example, in order to deliver project savings to the customers).

Capital deployed under this construct would be subject to the following terms:

- **Investment Type**: Debt (likely) or Equity (opportunistically);
- **Investment Return Profile**: An investment IRR not less than Green Bank return requirements across comparable investments (e.g. a C-PACE equivalent note yielding a C-PACE equivalent rate) nor more than a private investment in a similar facility given the risk-return expectations of the project portfolio;
- **Investment Risk Profile:** Underlying security, cashflow coverage, collateral, or otherwise equivalent to Green Bank risk requirements across comparable investments (e.g. a C-PACE equivalent IRR and structure carrying a C-PACE equivalent [over]collateral profile);
- **Investment Amount:** Anticipated to constitute no less than $1 million of the total not-to-exceed amount of $30 million[4] in new money authorized herein, subject to budget constraints.

Specifically, for investments in 3rd-party owned financing structures containing PPA projects not developed by Green Bank:

- **Investment Approval:** Investments below $0.5 million would be subject to Staff level approval, investments between $0.5 million and $2.5 million would be subject to approval by Deployment Committee and investments greater than $2.5 million would be approved by the Board.
- **Counterparty Selection:** Recipients of Green Bank capital would be pre-qualified as financing partners, via a public request for proposals. Refer to Exhibit B for a list of proposed pre-qualification criteria for such financing partners.

## Parameters for Development Capital and Construction Financing

Whether the Green Bank is developing a project and has not yet committed to the final financing/ownership structure for that project, or whether the Green Bank is providing development capital and construction financing to a project with either the intent of selling that project fully to a 3rd-party owned financing structure or rolling the construction financing into a term loan, the Green Bank may find it beneficial (both with respect to its own target returns and/or liquidity needs and broader market development) to deploy capital on a short-term basis in order to develop a project to the point that it can be monetized one way or another.

Green Bank staff therefore requests continuing authorization, pursuant to the Board approvals most recently granted at the Board's July 18, 2019 meeting, for the Green Bank to maintain its

[4] Originally approved in October 2018 at $15 million.

ability to deploy short-term capital for development and/or construction purposes. An example of how this works in practice is the relationship between the Green Bank and Onyx, who enjoyed a sourcing and servicing partnership from February 2017 until September 2019. Under the Commercial Solar Project Sourcing & Servicing Agreement (the "Onyx Agreement"), the Green Bank originated commercial PPA projects and provides continuing C-PACE related administrative services for C-PACE secured PPA projects. By way of reference, the Green Bank has, to date, earned more than $400,000 in sourcing fees associated with the first 9 MW+ of projects originated under the Onyx Agreement.

Under this approach, projects that do not fall into the Onyx ownership structure will instead be sold to another 3rd-party ownership structure, as contemplated to be the case with new market entrants such as IPC, Sunwealth and , more recently, Skyview Ventures.

Capital deployed under this construct would be subject to the following terms:

- **Investment Type**: Debt (opportunistically) or Equity (likely);
- **Investment Return Profile**: Market returns based upon underlying project cash flows, with an expectation for a full, short-term return of capital plus either a reasonable developer markup or a sourcing fee / rights to residual cash flows depending on partnership structure;
- **Investment Risk Profile:** Standard development risk (principally, for projects of this size / credit quality, a lack of potential term financing) to be mitigated either through an internal Green Bank solution for unconventional credits, or via a predetermined credit box with one or more long-term 3rd-party owners;
- **Investment Amount:** Anticipated to constitute approximately a target minimum of $1 million in revolving funds, out of the total not-to-exceed amount of $30 million in new money authorized herein, subject to budget constraints.

Specifically, for investments in 3rd-party owned financing structures containing PPA projects not developed by Green Bank:

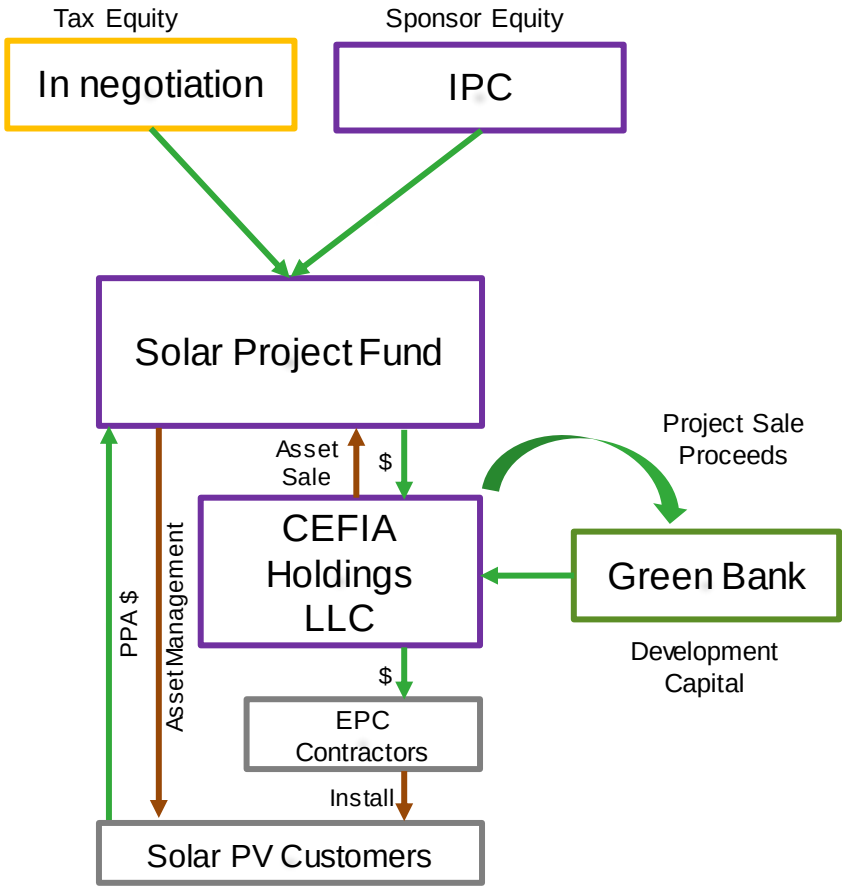
- **Investment Approval:** Investments below $0.5 million would be subject to Staff level approval, investments between $0.5 million and $2.5 million would be subject to approval by Deployment Committee and investments greater than $2.5 million would be approved by the Board.
- **Counterparty Selection:** Recipients of Green Bank capital would be pre-qualified as financing partners, via a public request for proposals. Refer to Exhibit B for a list of proposed pre-qualification criteria for such financing partners.

## Green Bank Participation and Financial Benefit

### Structure Diagram

The diagram below, taken from the August 21, 2018 memo to the Board of Directors, represents the world in the instance where the Green Bank provides development financing

and actively develops a project itself. To avoid confusion, rather than providing multiple diagrams, the authorizations requested in this memo would also allow the Green Bank to provide financing to a 3rd-party owner (in the case below, IPC) via, for example, debt directly to the solar project fund or back-leverage to the project sponsor.




## Ratepayer Payback

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

At a level of $10 million of term capital deployed, expected generation would be approximately 240 GWh over 25 years from an anticipated 8 MW of solar PV systems,[5] resulting in 240 kWh deployed per ratepayer dollar at risk.

## Financial Statements

*How is the program investment accounted for on the balance sheet and profit and loss statements?*

[5] Assuming $10 million makes up 50% of a project's capital stack, with an FMV of $2.50/W and average project yields of 1,200 kWh / kW

The capital deployed by the Green Bank as authorized herein will result in a decrease in Unrestricted Cash on the Green Bank's balance sheet and, depending on the use of funds, an equivalent increase in either a) short- or long-term promissory notes receivable (likely), b) the creation of a development asset at the level of CEFIA Holdings (likely), or c) the creation of a long-term asset through the Green Bank's ownership interest (sponsor equity) in a solar project holding company (only if determined to be needed due to unexpected market conditions).

### Risk to Ratepayer Funds

*What is the maximum risk exposure of ratepayer funds for the program?*

The maximum risk exposure of ratepayer funds for the program is a not-to-exceed amount of $30 million (subject to budget constraints), which may be development capital, construction or term debt capital to a 3rd-party solar project owner, or sponsor equity for a retained project.

### Target Market

*Who are the end-users of the engagement?*

Commercial, municipal, and institutional PPA off-takers within the state of Connecticut, particularly of benefit to nonprofits and unrated small and medium-sized businesses and corporates that might otherwise struggle to access solar PV in the current market environment.

## Program Partners

Key external players in the Green Bank's ongoing commercial solar PPA program could include:

- IPC
- Other PPA Sponsors including Sunwealth and Skyview Ventures
- Tax equity providers such as Enhanced Capital ("Enhanced")

High-level overviews of IPC and Sunwealth follow in Exhibit A to this memo, as does a representative term sheet for tax equity from Enhanced. As a reminder, staff is not suggesting to the Board that these are the only potential partners under this program as it evolves. Rather, these types of partners provide the capital, expertise, and flexibility that the Green Bank sees as necessary components to continue to accelerate the deployment of this evolving but still underserved sector of the market.

## Program Risks and Mitigation Strategies

The risks of structuring a commercial solar PPA financing program are well understood by the Green Bank given our deep experience operating in the market.

### Market and Origination Risk:

Risks:

- Commodity prices / utility rate changes making PPA rates charged a less viable option for repayment of capital providers

- Green Bank is unable to originate enough qualified projects to meet targets (either internal or under partnership agreements)
- If the pricing of future PPAs developed by the Green Bank is materially different from existing projects due to partner return requirements, the market may not be able to support pricing
- Public policy changes (e.g., from net metering to a tariff) that have an adverse impact on energy savings to end-use customers

Mitigation Strategy:

- Flexible approach to capitalizing these projects such that there are multiple potential partners available for term financing (including IPC), with the option for the Green Bank to place long-term debt (in addition to providing development capital) to ensure return hurdles are hit while retaining attractive pricing for customers
- Advocating appropriate tariff rates before PURA for behind the meter solar PV that balance ratepayer impact with end-use customer savings

## Structural risk:

Risks:

- Principally, Green Bank debt that is placed into a comingled portfolio of solar PPA projects across a 3rd-party owner's portfolio faces repayment risk that is not mitigated by Green Bank underwriting criteria due to exposure to projects that are outside of Green Bank's control

Mitigation Strategy:

- Green Bank will have either (i) segregated Connecticut project cash flow waterfall or alternatively (ii) a distinct tracking of the revenues, expenses and cash flows of Connecticut projects under the program satisfactory to Green Bank
- Green Bank will require appropriate minimum debt service coverage ratios of base case projections to mitigate risk of over leveraging and ensuring debt service requirements can be met
- Green Bank will require appropriate sponsor guarantees and reserves as necessary and maintain appropriate rights with respect to the underlying project collateral and/or the sponsor's equity interests therein

## Credit Risk:

Risk:

- Underlying off-takers fail to pay or default under the terms of the PPA

Mitigation Strategy:

- C-PACE as a security mechanism for unrated entities

- Well delineated credit requirements (for rated and unrated) requiring investor oversight
- Amongst other potential credit enhancements, requiring prepayments during tax credit recapture periods for weaker credits, as necessary

## System Performance Risk:

Risk:

- Solar PV systems supporting the solar PPA do not meet production expectations, the value proposition to commercial entities will decline, reducing energy savings

Mitigation Strategy:

- Strict EPC approval requirements ensuring EPCs have adequate experience, insurance, and finances to undertake project in a safe and effective manner, as well as ongoing oversight
- Enhanced commissioning protocols
- List of approved technologies, actively maintained/updated ensuring that technologies used are the most efficient, cost effective, and that manufacturers with the highest likelihood of being able to stand by their warranties are used
- Extensive diligence process for projects developed by 3rd parties.

## Development Risk:

Risk:

- Projects developed via CEFIA Holdings fail to reach completion

Mitigation Strategy:

- Continuation of existing Green Bank best practices with respect to project pricing, early fatal flaw analysis, rigorous negotiation of documentation, and contractor oversight
- Expansion of potential term financing solutions, including both competitive and strategic selections as authorized herein, to ensure all projects developed by the Green Bank find a long-term home with reasonable economic return for the Green Bank's invested resources and risk taken

## Resolutions

**WHEREAS**, when the Green Bank Board of Directors (the "Board of Directors") passed resolutions at its October 26, 2018 meeting, as modified by resolutions passed at its July 18, 2019 meeting, approving funding in a total not-to-exceed amount of $15 million in new money, subject to budget constraints, for the continued development of commercial-scale solar PV PPA projects, for development capital; construction financing; financing one or more 3rd-party ownership platforms, in the form of sponsor equity and/or debt; and selling solar PPA projects developed by CEFIA Holdings LLC ("Holdings") to third parties, the resolutions restricted projects so financed to those developed by Holdings;

**WHEREAS**, the Connecticut Green Bank ("Green Bank") is uniquely positioned to continue developing a commercial solar PPA pipeline through local contractors in response to continued demand from commercial-scale off-takers;

**WHEREAS**, the market for commercial solar PPA financing continues to evolve, as various financing providers are entering the small commercial solar financing space with the ability to provide long-term financing for projects originated by the Green Bank;

**WHEREAS**, there is still demonstrated need for flexible capital to continue expanding access to financing for commercial-scale customers looking to access solar via a PPA, while both bolstering project returns for investors and enhancing project savings profiles for customers; and

**WHEREAS**, the Green Bank is implementing a Sustainability Plan that invests in various clean energy projects and products to generate a return to support its sustainability in the coming years.

**NOW**, therefore be it:

**RESOLVED,** that the Board of Directors approves funding, in a total not-to-exceed amount of $30 million in new money (representing an increase of the previously approved not to exceed amount of $15 million), subject to budget constraints, for the continued development by Green Bank, and financing of development by 3rd parties, of commercial-scale solar PV PPA projects, to be utilized for the following purposes pursuant to market conditions and opportunities:

5. Development capital;
6. Construction financing;
7. Financing one or more 3rd-party ownership platforms, in the form of sponsor equity and/or debt; and
8. Sell solar PPA projects developed by Holdings to third parties.

**RESOLVED**, that the President of Green Bank; and any other duly authorized officer of Green Bank, is authorized to execute and deliver, any contract or other legal instrument necessary to continue to develop and finance commercial PPA projects on such terms and

conditions as are materially consistent with the memorandum submitted to the Green Bank Board on March 18, 2020 ; and

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

Submitted by: Bryan Garcia, President and CEO; Bert Hunter, EVP and CIO; Louise Della Pesca, Associate Director, Clean Energy Finance

**Exhibit A**
**Potential Commercial Solar PPA Program Partners**

**IPC**

INCLUSIVE
PROSPERITY CAPITAL

A CONNECTICUT GREEN BANK SPIN-OUT

SCALING COMMUNITY DEVELOPMENT IN UNDERSERVED MARKETS
THROUGH CLEAN ENERGY AND SOCIAL IMPACT INVESTMENTS

EXECUTIVE SUMMARY

INCLUSIVE PROSPERITY CAPITAL

## Opportunity & Approach

*Inclusive Prosperity Capital, Inc. is a not-for-profit specialty financing intermediary focused on aligning investment capital with organizations, projects, and community initiatives that successfully scale traditionally underserved markets:*

- **Low-to-Moderate Income** Residential Solar
- **Multifamily Housing** Developments & Retrofits
- **Solar** for C&I, Community Assets, and Nonprofits
- **Hydro** (Small-scale)
- **Fuel Cells**
- **Anaerobic Digestion**


**Capital + Products + Strategy** honed by key members of the IPC leadership team at the Connecticut Green Bank

**Fund Level Investment Options:**

Instruments:
- Debt + "Equity Equivalent"

Collateral: Unsecured
Recourse: Full Recourse

**Portfolio Investment Support:**

- Warehouse Financing
- Tax Equity Placement
- Direct Investment

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APPENDIX

INCLUSIVE PROSPERITY CAPITAL

# Distributed Solar PPAs

- **Target Market:** Municipalities, Non-Profits, Multifamily housing developments, Housing Authorities, Mid-Market Commercial
- **Credit Profile:** Investment Grade, Non-Investment Grade but credit-conforming or acceptable guarantor, or PACE-secured
- **Financing Structure:** Special Purpose Entity (SPE) with Sponsor Equity and Tax Equity participations, Levered as applicable (structured as either a partnership flip or inverted lease); IPC to serve as Sponsor based on experience deploying 35 MW+ to date
- **Repayment & Security Mechanisms:** PPA cash flows, REC cash flows, Tax benefits, asset liens, PACE liens (as applicable)
- **Investment/Return Profile:** 8%+ Sponsor Equity, 5-6% Term Debt (back-levered), market returns for Tax Equity across 20-Year PPA Terms
- **Facility Size:** 20 MW over 2-yr origination period (~$40 million total FMV, $15 million Tax Equity, $25 million Sponsor Equity / Term Debt)
- **CRA Eligibility:** Likely partially qualifying

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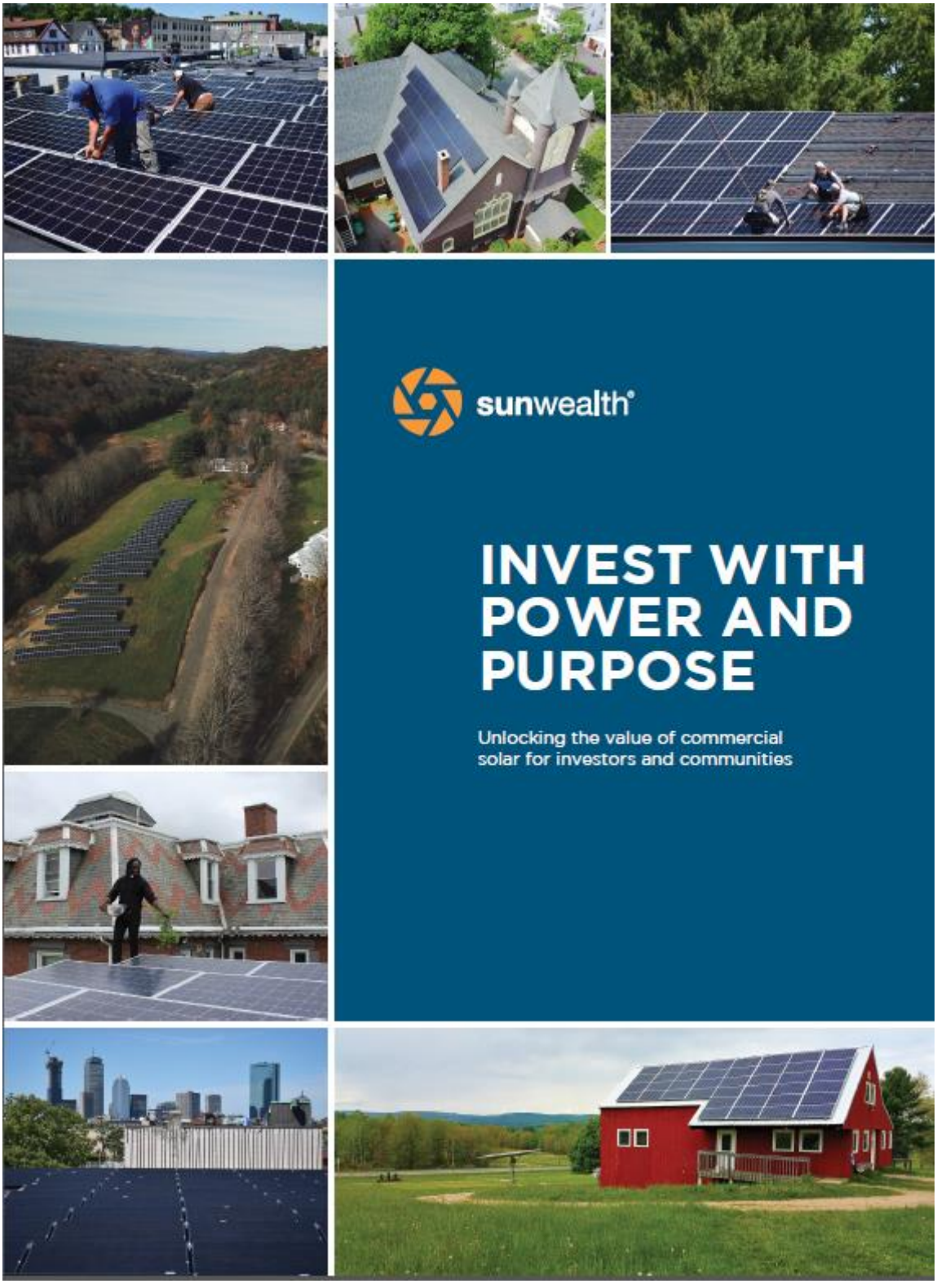
**Sunwealth**


sunwealth®
INVEST WITH POWER AND PURPOSE
Unlocking the value of commercial solar for investors and communities

## PURPOSEFUL INVESTMENT

Sunwealth's Solar Impact Fund brings together a diverse community of partners – including local solar developers, community groups, local businesses, and impact investors – committed to investing in a renewable energy future that benefits all of us.

### DIVERSE PROJECTS

We work with strong, local developers to pinpoint projects across our communities and design solar systems that deliver significant energy savings to power purchasers.


### STRONG UNDERWRITING

Proprietary review process ensures each project meets the highest quality standards. We are investing for the long haul in projects and partners that will be here for decades to come.

### SOLAR IMPACT FUND

A robust, diverse and transparent pool of high-performing commercial solar projects designed to deliver social, environmental and financial returns to investors and communities.

## POWERFUL RETURNS

Sunwealth generates powerful returns – for our communities, our local economy, our environment and our investors. We are reimagining the bottom line, building a portfolio that is diverse, transparent, inclusive and resilient.

### COMMUNITIES

Solar access and energy savings

### LOCAL ECONOMY

Jobs and income for local solar developers and installers

### ENVIRONMENT

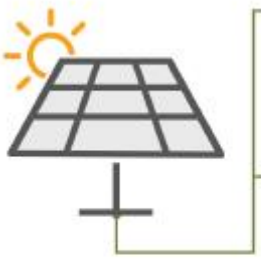
Carbon reduction

### INVESTORS

Fixed income from an alternative asset

## TWO WAYS TO INVEST

All Solar Impact Fund investors get the benefit of a simple, transparent investment in a diversified portfolio of solar projects owned and managed by Sunwealth. **Bond investors** receive fixed income returns over a 10-year term, with quarterly distributions of principal and interest. **Eligible tax equity investors** receive valuable tax benefits and preferred cash distributions over a 5-year term.



### BOND FUND

Invest in a diverse portfolio of solar projects and receive predictable returns over a 10-year term through quarterly distributions of principal and interest.

### TAX EQUITY

Turn a tax liability into an investment opportunity – invest in solar and receive tax credits, deductions and preferred cash return.

## Enhanced
## (Representative Term Sheet)

Based on the information provided by [Sponsor Entity], a [State] limited liability company ("[Abbreviated name]") and recent conversations regarding the Projects referred to below, Enhanced Capital Tax Credit Finance, LLC ("**Enhanced Capital**") is pleased to propose the following preliminary terms and conditions for a tax equity investment in connection with the Projects (defined below).

This term sheet (the "**Term Sheet**") does not constitute an offer or a solicitation of an offer to purchase or sell, nor is it a binding commitment by any party to purchase or sell, any equity or other interest in any of the Companies that own the Projects (defined below). The terms and conditions set forth in this Term Sheet are based on the information provided by [Sponsor Entity] as of the date hereof, without regard to the accuracy of the information provided, and remain subject to, among other things, completion of underwriting and due diligence, satisfactory documentation, investment committee approval by Investor (defined below) and review by Investor's legal and tax counsel.

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| ***Investor:*** | An affiliate or affiliates of Enhanced Capital ("**Investor**") |
| ***Sponsor:*** | [ ] |
| ***Managing Member:*** | An affiliate of Sponsor |
| ***Guarantor:*** | Subject to further due diligence, Sponsor and/or an affiliate of Sponsor |
| ***The Projects:*** | [ ] ([#]) [project type] solar energy projects (detailed in Appendix A to this Term Sheet), with an estimated aggregate nameplate capacity of [ ] MWdc, located in [ ] (each, a "Project", and, collectively, the "**Projects**"). The Projects and the other assets of the companies that own the Projects, including the Transaction Documents (defined below) are collectively referred to herein as "**Project Assets**". Sponsor shall be allowed to swap any Project detailed in Appendix A, subject to Investor approval. |
| ***Project Companies:*** | Each of the limited liability companies, which are the respective owners of the Projects (each, a "**Project Company**" and, collectively, the "**Project Companies**"). The sole business of each Project Company is to acquire, develop, build, operate and manage its Project, or Projects. |
| ***Investment Structure:*** | Investor and Managing Member will become the 100% owners of the membership interest in a to-be-formed limited liability company ("**Holdco**"), and the owner of 100% of the membership interests in each of the Project Companies. The post-closing ownership structure of the Sponsor, Managing Member, Guarantor, Holdco and the Project Companies is as set forth on Appendix C attached to this Term Sheet. Up |

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| | until the Flip Date (as defined below), the Managing Member will hold a 1% interest in HoldCo, and the Investor Member will hold a 99% interest in HoldCo. After the Flip Date, the Managing Member will hold a 95% interest in HoldCo, and the Investor Member will hold a 5% interest in HoldCo. |
| ***Federal ITC and Investor ITC:*** | It is anticipated that the Projects will qualify for approximately $[ ] million of federal business energy investment tax credits (**"Federal ITC"**) under Section 48(a)(3)(A)(i) of the Internal Revenue Code of 1986, as amended (the "**Code**") based on each Project's fair market value ("**FMV**"**)** appraisal prepared by a qualified third-party appraiser acceptable to Investor (the "**Appraiser**"), which FMV appraisal must be in form and content acceptable to Investor and its accountants.<br><br>It is anticipated that 99% of the Federal ITC will be allocated by the Holdco to Investor in an aggregate amount equal to $[ ] million (the **"Federal Investor ITC"**). |
| ***Capital Commitment:*** | Investor will contribute to the Holdco an amount equal to $[ ] per $1.00 of Federal Investor ITC (the "**Contribution Ratio**"). Based upon the current estimated Federal ITC amount, this will result in an aggregate capital contribution from Investor to the Holdco in the amount of $[ ] million (the "**Capital Commitment**"). |
| ***Capital Commitment Funding Installments:*** | It is expected that the Capital Commitment will be funded directly to the Holdco in two (2) installments (each, an **"Installment"**), as outlined below. Each Installment will be due and payable within ten (10) business days of the date on which all of the conditions precedent with respect to that installment have been completed or fulfilled to the satisfaction of Investor.<br>1. "**First Installment**": An Installment equal to twenty-five percent (25%) of the Capital Commitment, payable upon all conditions precedent to the First Installment being met for each Project.<br>2. "**Second Installment**": With respect to each Project, the Second Installment will be an amount equal to the Contribution Ratio multiplied by the final Federal Investor ITC as determined by a final appraisal provided by the Appraiser acceptable to Investor for such Project. The aggregate amount of the Second Installment shall not exceed seventy-five percent (75%) of the Capital Commitment. For each Project, the Second Installment shall be payable following satisfaction of all conditions precedent to the funding of the Second Installment for such Project, as provided in the Transaction Documents (as defined below). |

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| ***Conditions Precedent to Closing & First Installment*** | Usual and customary conditions precedent to closing and funding of the First Installment for each Project, including but not limited to the following:<br>• Investor's internal investment committee approval of the Projects;<br>• letter or report from an independent engineer acceptable to Investor (either addressed to Investor or covered by a reliance letter acceptable to Investor) that confirms that "mechanical completion" as defined in the EPC Contract has occurred for each of the Projects and that, as of the date of the First Installment, each of the Projects has not been Placed in Service;<br>• negotiation and execution of definitive Transaction Documents, mutually acceptable to all parties;<br>• completion of the Project Documents (as defined below);<br>• receipt by Investor of copies of lien releases and estoppel certificates in favor of Investor from the Project Document counterparties, as reasonably requested by and in form acceptable to Investor;<br>• satisfactory evidence that all governmental approvals then necessary and other third-party approvals have been obtained for the Projects;<br>• customary counsel opinions, including all corporate, formation and enforceability opinions rendered by Sponsor's counsel, subject to review and approval by Investor's counsel;<br>• evidence of ownership of the Project Assets by the Project Companies;<br>• receipt by Investor of title commitments (including copies of "schedule B" documents and other matters of record), copies of all leases and related property and zoning information, for the Projects;<br>• a pro forma or final owner's title insurance policy in favor of the Project Companies with respect to each Project, including such endorsements and coverage amounts as may be reasonably required, and otherwise acceptable to Investor;<br>• preliminary reports of the environmental consultant (if required based on Phase I report) and insurance consultant and reliance letters (if necessary);<br>• preliminary base case financial model provided by the Accountant;<br>• financial statements of the Guarantor and Sponsor;<br>• preliminary appraisal of each Project provided by the Appraiser;<br>• tax opinion of Investor's tax counsel;<br>• certified formation documents, resolutions and evidence of incumbency and good standing for each of Sponsor, Managing Member, Holdco and each Project Company;<br>• receipt of executed Loan Documents and the Forbearance Agreement (each defined below); and<br>• any other conditions that Investor requires based on further due diligence and comments from the Investors' investment committee. |
| ***Conditions Precedent to Funding Second Installment*** | Usual and customary conditions precedent to the Second Installment for each Project, including but not limited to the following:<br>• all material Project Documents and Transactions Documents in full force and effect, and no event of default under any material Project Document or any Transaction Document; |

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| | • all necessary government approvals obtained and in full force and effect;<br>• receipt of a final appraisals completed by the Appraiser;<br>• receipt of a letter or report from an independent engineer acceptable to Investor (either addressed to Investor or covered by a reliance letter acceptable to Investor) that the Projects have reached "substantial completion" and have been Placed in Service;<br>• bring-downs from Project Document counterparties, final lien releases, certificates and legal opinions;<br>• final reports/bring-downs from the environmental consultant and insurance consultant, and reliance letters (if necessary);<br>• revised base case financial model acceptable to Investor, adjusted for any change from the First Installment base case financial projections in project costs, transaction costs, funding date or material changes in scope or configuration of the Projects;<br>• initial operating budget for each Project Company;<br>• finalized Compliance and Asset Management Checklist (as defined below);<br>• appropriate insurance documentation delivered;<br>• final owner's policy for each Project (or date-down endorsement to the title policies, if applicable) in form and amount acceptable to Investor;<br>• funding of capital contribution by Managing Member, if applicable;<br>• reserve accounts required by the Loan Documents established and funded, if applicable;<br>• no casualty or condemnation has occurred and no material litigation;<br>• no material adverse change in law;<br>• any other conditions that Investor requires based on further due diligence and comments from the Investors' investment committee. |
| ***Placed in Service Date:*** | The Projects shall be considered **"<u>Placed in Service</u>"** when the following conditions have been satisfied:<br>• all material permits necessary to own, operate and maintain the Projects and to produce and sell electricity have been obtained and are in full force and effect;<br>• all work or services under the EPC contract have been performed such that the construction of the Projects are substantially complete;<br>• the Projects are installed, functional, and capable of producing usable energy;<br>• all critical tests necessary to ensure the operation and functionality of the Projects are complete; and<br>• the Projects have been synchronized with the utility grid, as evidenced by a permission to operate letter received from the utility, and has commenced daily and regular operation. |
| ***Allocation of Profits, Losses and Credits:*** | Net income or net loss from the Holdco will be allocated ninety-nine percent (99.0%) to Investor and one percent (1.0%) to the Managing Member up until the "**<u>Flip Date</u>**," which will occur on the 5-year anniversary of the date the final Project is Placed In Service; provided that, subject to |

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| | tax counsel review, Investor will designate a maximum amount of taxable losses that will be allocated to Investor prior to the Flip Date and all other taxable losses not so allocated shall be allocated to the Managing Member.<br><br>On and after the Flip Date, net income or net loss from the Holdco will be allocated 5% to Investor and 95% to the Managing Member. |
| ***Preferred Return:*** | The annual preferred cash distribution to Investor up until the Flip Date shall be in an amount equal to [ ]% of the Investor's funded Capital Contribution payable quarterly ("**Preferred Return**"). The Investor's applicable preferred return shall be due and payable by the Holdco at the end of each quarter. At Investor's discretion, the Preferred Return payments that remain unpaid after ten (10) business days shall bear interest at the Penalty Rate (as defined below). |
| ***Call Option:*** | Commencing with the flip date and for a period of 180 days thereafter, the Managing Member shall have the option to purchase all of the Investor's partnership interests in the Holdco at a purchase price equal to the greater of the following plus any unpaid Preferred Return and accrued interest at the Penalty Rate: (a) fair market value of such partnership interests as of the Flip Date, and (b) [ ]% of the Capital Commitment (the "**Call Price**").<br><br>If the call option is exercised but the Call Price is not paid within thirty (30) days after the date of exercise, it shall convert to a promissory note, payable quarterly, that accrues interest at the Penalty Rate, and amortizes fully over one-year (the "**Call Option Note**"). The Call Option Note shall be secured by the managing member's interest in the Holdco, subordinated only to any pledge given in favor of the Lender pursuant to the Loan Documents (as each is defined below). |
| ***Put Option:*** | Commencing with the Flip Date and for a period of 180 days thereafter, Investor shall have the right to withdraw from the Holdco for a price (the "**Put Price**") equal to the lesser of the following plus any unpaid Preferred Return and accrued interest at the Penalty Rate:<br><br>(a) [ ]% of the Capital Commitment; and<br>(b) The fair market value of the Investor's partnership interests in the Holdco as of the date of exercise.<br><br>If the put option is exercised but the Put Price is not paid within thirty (30) days, it shall convert to a promissory note, payable quarterly, that accrues interest at the Penalty Rate, and amortizes fully over one-year (the "**Withdrawal Note**"). The Withdrawal Note shall be secured by the managing member's interest in the Holdco, subordinated only to any pledge given in favor of the Lender pursuant to the Loan Documents (as each is defined below). |

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| ***Cash Distributions:*** | The Holdco shall distribute all Net Cash Flow (as defined below) on a quarterly basis as follows, subject to review by the Investor's tax counsel and the Lender:<br><br>1. To Investor, any payments due and payable based on execution of the Call Option or Put Option (both defined below);<br>2. To Investor, an annual Preferred Return distribution equal to the applicable Preferred Return payable quarterly;<br>3. To Investor, the payment of any Special Tax Distribution (as defined below);<br>4. To Investor, the payment of any amounts, including interest and penalties, resulting from the recapture of the Federal Investor ITCs.<br>5. To the Managing Member, a distribution equal to up to [ ]% of remaining cash flow, payable quarterly and to-be-determined after receipt of a preliminary base case financial model provided by the Accountant and in accordance with the final Transaction Documents;<br>6. The balance, if any, shall be distributed to the Members according to their respective ownership interests in the Holdco. |
| ***Net Cash Flow:*** | Means for each calendar quarter, the sum of (i) Operating Income and (ii) any other funds deemed available for distribution by the Managing Member, less the sum of all Operating Expenses, debt service and other payments due and owing by the Company under the Loan Documents. |
| ***Delayed Project(s):*** | Any Project that has not been Placed in Service by December 31, 2018 will be considered, at the Investor's sole discretion, a "**Delayed Project**".<br><br>If the total amount of the Federal ITC received by the Investor for Projects that Placed in Service by December 31, 2018, does not equal at least $[ ] in Federal Investor ITC, the Investor may, in its sole discretion require Sponsor (with a guarantee, by the Guarantor) to pay investor a fee equal to 10% of the difference between $[ ] million and the actual amount of Federal Investor ITC received for Projects that Placed in Service by December 31, 2018 (the "**Delayed Project Fee**").<br><br>The Delayed Project Fee shall be due and payable within ten (10) business days upon notification by Investor, or, at the option of Investor, to be offset against the amount of any portion of the Second Installment (whether or not related to the Delayed Project).<br><br>With respect to any Delayed Project, Investor shall have no obligation to fund its Capital Commitment, but shall retain the sole and exclusive right to fund its Capital Commitment until February 15, 2019. If Investor decides to fund a Delayed Project it may, in its sole discretion, decrease the Contribution Ratio by $[ ] per $1.00 of Federal Investor ITC, and the Capital Commitment to shall be reduced to reflect such adjustment<br><br>If Investor delivers written notice to Sponsor that Investor declines to invest in any Delayed Project, Sponsor shall pay to Investor an amount |

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| | equal to the sum of all funded payments of its Capital Commitment with respect to the Delayed Project plus the Delayed Project Fee (each such payment, a "**Capital Contribution Withdrawal**"). Each Capital Contribution Withdrawal shall be due and payable within ten (10) business days following delivery of such notice by Investor, or, at Investor's option, may be offset against any Second Installment payable by Investor with respect to any other Project. In addition, at the Investor's discretion, Capital Contribution Withdrawals which remain unpaid after ten (10) business days shall bear interest at the Penalty Rate (defined below). Payment of all Capital Contribution Withdrawals shall be guaranteed by the Guarantor (or Sponsor). |
| ***Penalty Rate:*** | Failure by any Partner or Sponsor to pay to Investor any Preferred Return, Delayed Project Fee, Call Price, or Put Price by their respective due dates shall trigger quarterly interest payments equal to the greater of fifteen percent (15%) annually, or the maximum interest permitted by applicable law (the "**Penalty Rate**"). In addition, Sponsor will pay to Investor a Late Payment Fee of $500.00 for each late payment event, which shall be payable within ten (10) business days of the late payment date. |
| ***Project Documents:*** | Each Project Company will enter into and perform its obligations under appropriate power purchase contracts, leases, permits, interconnection agreements, maintenance and service agreements, tax agreements with local taxing authorities and other contracts, agreements, permits or similar documents usual and customary to a solar power project of the same type as the Project (collectively, "**Project Documents**"), all in form and content acceptable to Investor and its legal and tax counsel. |
| ***Transaction Documents:*** | All of the forms, terms, conditions, covenants, representations, warranties and requirements for the proposed investment will be included in definitive legal documentation mutually acceptable to the parties (collectively, the "**Transaction Documents**"), all in form and content acceptable to Investor and its legal and tax counsel. Except for the obligations contained in the sections entitled "Non-Solicitation/Confidentiality" and "Expenses," nothing contained or contemplated in this Term Sheet will be binding on either party unless and until the Transaction Documents have been entered into by the parties. |
| ***Debt Financing / Forbearance Agreement / Guaranty*** | There will be debt financing provided to the Projects by a lender (the "**Lender**"), which is anticipated to be secured by that Project, and which shall be made pursuant to loan documents acceptable to Investor in form and content, including non-disturbance and forbearance provisions as |

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| | required by Investor (collectively, the "**Loan Documents**"). In the event a security interest in the assets of the Project Company will be granted to the Lender pursuant to the Loan Documents, the Lender shall execute a forbearance agreement in substantially the form provided by Investor in Exhibit A (the "**Forbearance Agreement**"), with any changes as may be agreed to by Investor and the Lender, and such Forbearance Agreement will provide that the forbearance period will not end until Investor has been paid the Call Price or Put Price in full. In addition, a guaranty or any security agreement provided by the Project Company shall be permitted only if action to collect on such guaranty or security agreement is covered by the terms of the Forbearance Agreement and such documents are reasonably acceptable to Investor in form and content, including but not limited to reasonable notice and cure provisions in favor of the Project Company and Holdco. |
| ***Special Tax Distribution:*** | Investor reserves the right to require tax distributions on income allocated that differs materially in amount from projected income as projected in the base case financial model and/or that causes the Investor to recognize tax income when it is not receiving corresponding cash payments. |
| ***Guaranty*** | The Transaction Documents will include a mutual agreed upon guaranty in favor of Investor, guaranteeing indemnity obligations of Managing Member, Holdco and the Project Companies, in form and content acceptable to Investor. |
| ***Non-Solicitation / Confidentiality:*** | Investor will forego opportunities and incur expenses while working on this transaction. Investor will do so only if it maintains an exclusive right to acquire the Federal Investor ITC anticipated to be qualified for by the Projects and other rights outlined in this Term Sheet while this Term Sheet is in effect. As used herein, the term "exclusive right" means that none of Sponsor or any of its affiliates will engage in any negotiations, and each of them will terminate any existing negotiations, with other parties concerning the Federal Investor ITC anticipated to be qualified for by the Projects and other rights provided to Investor with respect to the Projects as outlined in this term sheet and each of them will also terminate and not enter into any letter of interest, commitment letter, term sheet or other agreement concerning the Federal Investor ITC and other rights provided to Investor with respect to the Projects as outlined in this Term Sheet. Sponsor, for itself and its affiliates, agrees that it has not entered into any other term sheet, commitment or letter of interest or other arrangement with respect to the Federal Investor ITC and other rights provided to Investor with respect to the Projects as outlined in this Term Sheet, and to keep and cause its employees to keep all information provided by Investor (including this Term Sheet) confidential and to not disclose such |

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| | information without the prior written consent of Investor; provided that it may disclose such information to its advisors for the transaction if such persons agree to comply with these confidentiality requirements. These confidentiality requirements will terminate upon execution of the Transaction Documents or the termination of this Term Sheet by written agreement (which may be via email) by each of the parties hereto. The exclusive rights of Investor set forth herein will terminate upon the earlier of (i) signing of the Transaction Documents (ii) termination of this Term Sheet pursuant to the next sentence or (iii) December 31, 2018. Investor will terminate the exclusivity period at any time if, in its reasonable discretion, it believes that it cannot agree to the form of Transaction Documents after good faith negotiations by all parties. |
| ***Right of First Refusal for Subsequent Sponsor Transactions:*** | The Transaction Documents will provide Investor with a right of first refusal to provide tax equity financing to the projects listed on Appendix B hereto (**"2018 ROFR"**), on the same terms and conditions as the Investor's investment in the Projects. As part of the 2018 ROFR, Sponsor will agree to provide notice to Investor at least 30 days prior to entering into an agreement with any third party to provide tax equity for the ROFR Projects and, at Investor's election, it will have 10 days following such written notice to enter into Transaction Documents substantially similar to, or as part of the same transaction contemplated by this Term Sheet with respect to the 2018 ROFR Projects. |
| ***Expenses:*** | Sponsor shall be responsible for the reasonable, third party expenses of Investor incurred in connection with this Term Sheet and the transactions contemplated hereby (collectively, the "**Expenses**"), including without limitation the reasonable expenses of Investor's counsel related to closing the transaction and the additional installments in an amount not to exceed $[ ]. At the request of Sponsor, Investor will provide regular updates regarding the amount of expenses incurred to date. Upon signing the Term Sheet, Sponsor will make an expense deposit of $[ ] to the Investor. |
| ***Compliance and Asset Management Checklist*:** | Investor will prepare and provide to Sponsor for review prior to the applicable First Installment, a Compliance and Asset Management Checklist that will include a list of reporting requirements and deadlines outlined in the provisions of the Operating Agreements, the Asset Management Agreement and certain other Transaction Documents. |
| ***Audit & Tax Preparation Costs:*** | The Holdco, Sponsor and the Guarantor, at their own respective cost, shall deliver: (a) audited financial statements from a nationally recognized accounting firm acceptable to Investor and its members each year within 135 days after the end of each fiscal year; (b) unaudited financial |

| | |
|---|---|
| | statements within 60 days after the end of each fiscal quarter; and (c) a tax return including draft Schedule K-1 within sixty (60) days and a final Schedule K-1 within ninety (90) days after the end of each calendar year. |
| ***Closing:*** | Closing is expected to occur on or before [Month, Day, Year]. |
| *State Contracting:* | The Connecticut Green Bank is subject to the requirements outlined in Sections 16-245n of the Connecticut General Statutes and all parties will be responsible for complying with applicable state contracting and freedom of information requirements. |
| *Governing Law/Forum:* | New York, New York City; except that the Holdco Operating Agreement will be governed by Delaware law |

If the terms herein are generally acceptable to you, please sign below and return by [Date]. This Term Sheet and the proposals contained herein will expire at 5:00 pm EST on [Date] if Investor fails to receive Sponsor's executed signature to this Term Sheet**.** Upon acceptance, we consider all communications in connection with this Term Sheet and the matters contemplated hereby to be confidential to the extent permitted under the Connecticut Freedom of Information Act. Any violation of this condition shall be considered detrimental and may subject the signor and related parties to damages to be determined by a court of competent jurisdiction. Notwithstanding anything set forth elsewhere in this Term Sheet, the Expenses provision will survive any termination of this Term Sheet for any reason.

Sincerely,

ENHANCED CAPITAL TAX CREDIT FINANCE, LLC

## Exhibit B

## Proposed Pre-Qualification Criteria for Recipients of Green Bank Capital for Investments in PPA Projects Developed by Third Parties

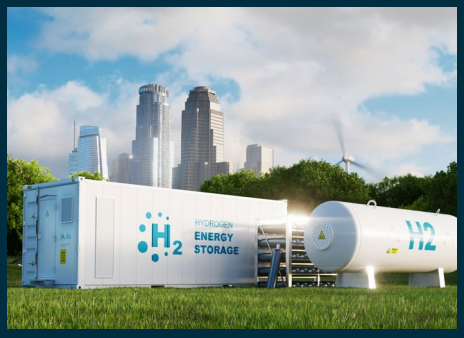
- At least five years operating history including at least one year operating history in the state of Connecticut
- Either: at least 1 MW capacity of commercial solar assets under management; or: at least 5 MW capacity of commercial solar assets installed
- No instance of default on a power purchase agreement
- Established program of asset management, to include: contracted operations and maintenance services and ability to obtain production data on a monthly basis
- Acceptance of non-negotiable requirement for Green Bank to secure loans by a first priority lien on assets against which loans are advanced
- Acceptance of non-negotiable requirement that proceeds of loans will be used for the development and longer term financing and refinancing of clean energy projects situated in the state of Connecticut

CONNECTICUT GREEN BANK

STRATEGEN

# Connecticut Hydrogen Task Force Study

Submitted to the Energy & Technology Committee of the Connecticut General Assembly per Special Act 22-8






## About Strategen

Strategen advises and empowers leading organizations — utilities, government agencies, NGOs, and industry clients — to design innovative, practical solutions that capture the promise of a clean energy future, strengthen resilience and adaptability, and are equitable, collaborative, and impactful.

Headquartered in Northern California, and with offices across the western U.S. and in Australia, Strategen's mission-driven experts leverage a global perspective and market-leading capabilities to deliver novel, high-impact, stakeholder-aligned approaches across the policy, regulatory, and market design spheres that sustainably accelerate the deployment of low-carbon energy systems.

Strategen's expertise spans corporate strategy, energy system planning, policy and regulatory innovation, and multi-stakeholder engagement. We take an integrated, multidisciplinary approach, informed by our core values of intellectual honesty, humility, sustainability, diversity, and inclusion. Learn more at www.strategen.com.

## About the Connecticut Green Bank

The Connecticut Green Bank was established by the Connecticut General Assembly in 2011 as the nation's first green bank and has since supported the creation of more than 26,000 green energy jobs in the state while reducing the energy cost burden on over 66,000 families, businesses, and nonprofits. The Green Bank's mission is to confront climate change by increasing and accelerating investment into Connecticut's green economy to create more resilient, healthier, and equitable communities. This is accomplished by leveraging limited public resources to scale up and mobilize private capital investment into Connecticut. To date, the Green Bank has mobilized nearly $2.5 billion into the State's green economy. Learn more at www.ctgreenbank.com.

This report has been prepared by Strategen on behalf of the Connecticut Green Bank for submission to the Connecticut Legislature consistent with the requirements of Special Act 22-8. The process had a number of other stakeholders and members of the public participate in the various meetings. We appreciate their contributions as well. For details, see www.ctgreenbank.com/hydrogentaskforce



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# Connecticut Hydrogen Task Force Study Table of Contents

# 1 | Executive Summary

Economy-wide decarbonization is urgently needed to mitigate climate change and protect our communities' public health and infrastructure. To fully decarbonize energy systems, a "clean molecule" that has little or zero carbon characteristics, such as clean hydrogen, will be required to replace fossil fuels in many applications.

Clean hydrogen can play a major role in eliminating harmful greenhouse gas (GHG) emissions across the global economy as a carbon-free form of fuel and energy storage. Its versatility to provide heat, fuel, and power system services can be leveraged in multiple vital economic sectors that are challenging to decarbonize, such as aviation, maritime applications, heavy-duty trucking, and high-temperature industrial processes, among others. With numerous ways to produce hydrogen, the specific approach chosen significantly impacts the carbon intensity – the fuel's life cycle greenhouse gas emissions per unit of fuel or energy delivered – of the hydrogen produced as well as its associated decarbonization benefits. Federal guidance from the proposed Clean Hydrogen Production Standard established "clean hydrogen" as that with less than 4 kg of CO2e/kg H2 on a lifecycle basis (well-to-gate).

Interest in the production and use of clean hydrogen in Connecticut is growing, due in no small part to the state's deep experience with fuel cell and electrolyzer manufacturing, the billions of dollars in new federal grants and tax credits available in the near term via the Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act (IRA), and state and regional climate and clean energy goals. However, stakeholders have raised concerns regarding hydrogen safety, end use prioritization, cost effectiveness, community impacts, and appropriate definitions for clean hydrogen.

Clean hydrogen can play an important role in Connecticut's decarbonization efforts and overall economic growth. However, the scale of its role will be determined not only by economic and market forces but also by actions taken at the state, regional, and federal level. This report presents the findings and recommendations of the Hydrogen Power Study Task Force (Task Force) established by Special Act 22-8, which required a study of the regulations and legislation needed to guide the development of hydrogen power in Connecticut, an examination of incentives and programs created by federal legislation, and an investigation of sources and uses for potential clean hydrogen power.

## 1.1 | Summary of Findings

The Task Force has developed a set of fact-based findings based on (a) research on current state of funding, policy activities, and infrastructure best practices; (b) original analysis on hydrogen costs and availability based on publicly available datasets; and (c) stakeholder feedback, recommendations, and resources. The Task Force found that clean hydrogen is an essential component of a just and sustainable clean energy transition, addressing Connecticut's economy-wide deep decarbonization goals and other issues related to energy equity and energy justice.

As a low or zero-carbon fuel, hydrogen can reduce reliance on existing fossil fuel end uses that have negative climate and human health impacts. Moreover, given the similar infrastructure required for molecular energy sources like hydrogen and natural gas, investment in hydrogen infrastructure can help to facilitate a just additional equitable benefits by helping to unwind many harmful impacts of the fossil fuel economy, including disproportionate impacts on environmental justice communities and low-income and minority residents.

Low or zero-carbon hydrogen fuel can be used in hard-to-decarbonize end uses such as aviation, maritime, heavy-duty trucking, and high-temperature industrial processes. Certain hydrogen-compatible applications, such as material handling equipment like forklifts, can economically convert to hydrogen fuel today. Other hydrogen end uses such as aviation or maritime shipping will not be ready until closer to 2030 when costs for delivered hydrogen and infrastructure should decline due to global and federal investments and economies of scale.

Developing a cost-effective hydrogen economy requires deployment of at-scale hydrogen production, storage, transport, and offtake infrastructure. One challenge for scaled hydrogen production via electrolysis is the total electricity required to produce hydrogen. While Connecticut has significant resources for hydrogen production across on- and off-shore wind, solar, biogas, and nuclear, many of these resources must also support achievement of the state's zero-emissions electric sector goals. Offshore and on-shore wind and utility-scale solar, as well as on-shore wind, represent the most abundant and lowest cost sources for hydrogen production. However, Connecticut has limited on-shore and off-shore wind projects that directly interconnect into the State, relying on a regional transmission grid for delivery of those resources. Thus, additional study is necessary to ensure the simultaneous attainment of the state's existing decarbonization objectives and potential new hydrogen deployment goals.

Hydrogen transport and storage are critical components of the hydrogen value chain and significantly impact overall delivered costs of hydrogen and additional greenhouse gas emissions. Hydrogen can be stored at smaller scale in liquified or compressed form, or via an alternative compound such as ammonia, but the most cost-effective method is large-scale hydrogen storage in underground storage facilities, such as salt domes. Salt domes are naturally occurring geological features, and the closest salt dome formations are located in western New York. There are two primary mechanisms for scaled hydrogen transport – first, transporting hydrogen molecules via pipelines, or transporting electricity via transmission lines to power distributed electrolyzers that create hydrogen molecules.[1] Today, most hydrogen transport occurs via truck, which contributes significantly to overall delivered costs. Funding support from state and federal sources will support affordability and jump start deployment of hydrogen infrastructure and offtake opportunities.

Recent federal legislation, such as the IIJA and the IRA, earmarked significant funding for hydrogen investments throughout the value chain. These opportunities include grants for developing regional hydrogen hubs; zero-emissions mobility programs that apply to hydrogen-fueled heavy-duty trucks, material handling equipment, cargo ships, and aviation fuels; tax incentives for hydrogen production; and funding for manufacturing and workforce development. A full list of these opportunities can be found in Appendix D. However, much of this funding depends upon various requirements, including supplying non-federal match funding and compliance with the federal government's "Justice40" initiative. Connecticut is well positioned to capitalize on federal funding opportunities given its many competitive strengths, including its participation in the Northeast Regional Hub application effort, its strategic positioning along high-volume transit corridors, its presence of a robust and nation-leading fuel cell and electrolyzer industry, and its existing efforts to support community engagement, particularly within disadvantaged communities. However, given federal match funding requirements and the imminent timing of funding applications, Connecticut must urgently consider its resources and funding strategy if the state wishes to capture significant federal funding.

1 Other forms of scaled hydrogen transport, such as rail or maritime shipping, can also be evaluated for cost-effectiveness and suitability.

Connecticut has strong policy commitments to decarbonization[2], which provides robust support to develop a clean hydrogen economy to support state goals. Clean hydrogen can play an important role in Connecticut's decarbonization efforts, depending on actions taken at federal, regional, and state levels. State regulatory and policy action can help create regulatory clarity and a harmonized state-level vision that will advance clean hydrogen development and deployment in Connecticut by providing market certainty and addressing stakeholder concerns related to hydrogen.

## FUEL CELL DEPLOYMENT IN THE FUEL CELL STATE

As the "Fuel Cell State," Connecticut is known nationally and internationally for its strong stationary fuel cell manufacturing sector. There is also a growing fleet of fuel cells being deployed in Connecticut. The following tables provide a breakdown of fuel cell projects and installed capacity in development (i.e., application approved) or energized from 2010 through 2022 by manufacturer.

There are approximately 130 fuel cell projects in Connecticut totaling nearly 180 MW of fuel cell deployment – of which nearly 60% of the installed capacity are using Connecticut manufactured fuel cells.

**Behind the Meter** projects are located on the customer side of the meter, including:

| Company | Projects | Installed Capacity (MW) |
|---|---|---|
| Bloom | 71 | 52 |
| FuelCell Energy | 9 | 13 |
| HyAxiom | 35 | 20 |
| **Total** | 115 | 85 |

**Grid Tied** projects are directly connected to the grid, including several Shared Clean Energy Facility Program projects in development:

| Company | Projects | Installed Capacity (MW) |
|---|---|---|
| Bloom | 2 | 19 |
| FuelCell Energy | 11 | 57 |
| HyAxiom | 2 | 15 |
| **Total** | 15 | 91 |

2 Connecticut Gen. Stat. Sec. 22a-200a, as amended by the Global Warming Solutions Act (GWSA) (2008).

## 1.2 | Summary of Recommendations

The Task Force has developed recommendations based on in-depth analyses and research, expert input, and stakeholder feedback. Recommendations identify potential actions that state entities could take to enable the growth of a clean hydrogen economy in Connecticut and are structured according to which entity that should lead such activities, including (1) the Legislature; (2) State Government Agencies; and (3) Industry and Academia. Of note, other organizations, including communities, environmental organizations, and labor, will be critical contributors to ongoing and recommended stakeholder processes.

### 1.2.1 | Actions to be taken by the Legislature

There are opportunities for direct action by the Legislature to support the development of Connecticut's hydrogen economy. Legislative recommendations are focused on required statutory changes, funding for hydrogen development, and enabling actions to promote community engagement and transparency.

**To enable community engagement, outreach, and education efforts, the Legislature should:**

+ Create a transparent source for municipalities, cities, and other local applicants to access resources, such as match funding and/or application guidance.
+ Provide funding to increase community engagement and decrease the burden of engagement on communities.
+ Consider amending requirements for community benefit agreements, through Public Act 21-43, to lower the minimum project size from 2 MW to 1 MW, explicitly note the inclusion of hydrogen, and consider the development of similar requirements for all hydrogen projects.

**To provide support for high value end uses for hydrogen, the Legislature should:**

+ Consider appropriating grant funding to support federal match requirements.
+ Consider tax exemptions for hydrogen vehicles and critical facilities that produce or use clean hydrogen.
+ Evaluate broader policies that would facilitate the decarbonization of hard-to-electrify sectors, including long-haul heavy-duty trucking, aviation, shipping, and industrial processes.

### 1.2.2 | Actions to be taken by State Government Agencies

State Government Agencies have opportunities to lead further investigation into clean hydrogen planning, funding, and policy, and to create appropriate venues to engage with critical ecosystem stakeholders on crosscutting issues related to the future of hydrogen in the state. Relevant topics include of additional investigation of hydrogen production, infrastructure and end uses; identification and expansion programs relevant to hydrogen; evaluation of additional funding needs; and advancing actions to promote community engagement and transparency.

#### 1.2.2.1 | Actions to be taken by DEEP

The Connecticut Department of Energy and Environmental Planning (DEEP) is the appropriate entity to address hydrogen-related activities core to energy and environmental planning for the state, and should consider undertaking the following actions:

+ Conduct further investigation to ultimately establish a definition of clean hydrogen that would be most appropriate for Connecticut.

+ Continue to evaluate the sufficiency of zero-emission electricity sources to meet both electric sector decarbonization goals and hydrogen production targets.
+ Investigate accounting mechanisms that encourage hydrogen producers to certify the carbon intensity of produced hydrogen.
+ Investigate the possibility of focused policy and market development support for clean hydrogen production and use in the highest priority end uses. These highest priority end uses include:
  - Aviation (long- and medium-haul)
  - Cargo ships
  - Critical facilities (24-hour backup need)
  - High heat industrial processes
  - Hydrogen fuel cells for peak power generation
  - Long-haul trucks
  - Material handling equipment with long uptimes and charging space or time constraints
+ Further investigate into high priority hydrogen end uses and the possibility of coordinating support measures with other hydrogen efforts. These include:
  - Ferries
  - Freight rail
  - Heavy-duty vehicles with charging constraints (e.g., drayage trucks, some commuter buses)
  - Hydrogen blending for non-core customers (i.e., power generation and industrial heat)
  - Long-distance buses
  - Specialty fleet vehicles with long uptimes and specific refueling locations
+ Explore market-based approaches to incent reductions in the carbon intensity of fuels for mobility end use applications.
+ Identify and potentially expand clean transportation incentives to include on-site port handling equipment, harbor crafts, and ocean-going vessels, in collaboration with other state and federal agencies.
+ Investigate the need for hydrogen fueling stations to support multi-sectoral mobility applications, and as appropriate, coordinate with CT Department of Transportation to develop more specific strategies for optimizing siting and funding.
+ Lead interstate and interagency coordination to develop a hydrogen roadmap and strategy that identifies hydrogen supply and demand scenarios; approaches to a clean hydrogen backbone to enable cost-effective scaled transport; and other research and infrastructure investment opportunities to inform policy development and funding and research, development, and deployment (RD&D) strategy, in consultation with ecosystem stakeholders.
+ Solicit feedback and guidance from the Connecticut Equity and Environmental Justice Advisory Council (CEEJAC) to advance community impact, environmental justice, and energy equity discussions on hydrogen and to support the development of a framework that outlines both a vision and goals for Connecticut's clean hydrogen policies.

#### 1.2.2.2 | Actions to be taken by PURA

The Connecticut Public Utilities Regulatory Authority (PURA) is the appropriate entity to incorporate hydrogen into electric distribution company (EDC) and local distribution company (LDC) planning and update relevant programs that may be relevant to hydrogen, and should consider undertaking the following actions:

+ Evaluate the role of stationary hydrogen fuel cells for critical backup power and peak power generation and identify approaches to incorporate recommendations into appropriate planning venues.
+ Consider whether existing renewable energy, flexible and/or interruptible load tariffs could be applied to electrolytic hydrogen production and determine if a specific electrolytic tariff would be required.

#### 1.2.2.3 | Actions to be taken by DECD

The Connecticut Department of Economic and Community Development (DECD) is the appropriate entity to provide support for the suite of brownfield funding opportunities, and should consider undertaking the following actions:

+ Evaluate the need for additional funding for the Brownfield Loan and Grant programs to help meet the clean energy needs of the state and its subsequent land requirements.
+ Establish a Strategic Innovation Fund with bond funds to encourage research, development, and deployment (RD&D) that will accelerate technology transfer and commercialization of innovative products, processes, and services related to hydrogen with guidance from an Industry Advisory Board.

#### 1.2.2.4 | Actions to be taken by the OWS

The Connecticut Office of Workforce Strategy (OWS), working in collaboration with UCONN, community colleges, and local universities, should address hydrogen and fuel cell related workforce development needs:

+ Lead coordination – in partnership with UCONN; community colleges; vocational high schools; regional comprehensive universities; Workforce Investment Boards; trades with expertise in hydrogen technologies and relevant skillsets; labor-led workforce development programs and training programs; LDCs, EDCs, and other employers; and any other relevant workforce or training programs – between existing entities such as the Governor's Workforce Council and DEEP to establish a comprehensive program for engagement with local experts to understand workforce development needs and potential specific to hydrogen and hydrogen technologies such as fuel cells and electrolyzers as well as upstream suppliers.
+ Partner with relevant state agencies and UCONN; community colleges; vocational high schools; regional comprehensive universities; Workforce Investment Boards; trades with expertise in hydrogen technologies and relevant skillsets; labor-led workforce development programs and training programs; LDCs, EDCs, and other employers; and any other relevant workforce or training programs to further advance the development of a skilled hydrogen workforce and durable supply chain.

#### 1.2.2.5 | Interagency Actions

Given the nascency of the clean hydrogen industry, and recent developments in federal funding, some actions are best undertaken collaboratively by multiple state agencies. Specifically, interagency coordination will be required to address hydrogen infrastructure, safety, and community protection:

+ DEEP and PURA may wish to consider promoting hydrogen end uses that are currently commercially viable through the existing clean energy programs, including projects developed by both third parties and affiliates of the EDCs and LDCs. PURA's consideration should include how any changes would affect the programs' existing objectives and cost-effectiveness.

+ DEEP and DECD should continue maintaining the Connecticut Brownfields Inventory as a resource for potential developers to identify prospective project sites and should consider expansion of the list to include those potentially eligible as "energy communities" under the Inflation Reduction Act.[3]
+ DEEP and PURA should consider implementing an intervenor compensation program to increase community participation in hydrogen-related proceedings.
+ DEEP and DECD should continue supporting development of clean energy projects on brownfields and projects that have community support and/or have completed community benefits agreements.
+ DEEP should clarify and work with relevant agencies and stakeholders to explore the acceleration of permitting for clean hydrogen infrastructure, while ensuring appropriate guardrails to avoid unintended adverse impacts.
+ State agencies should identify appropriate leads to coordinate on hydrogen safety with local and federal organizations to allow for alignment and clear flow on best practices, policy developments, trainings, and certifications.
+ DECD and OPM should identify opportunities for tax incentives or programs to retain Connecticut's leadership in the electrolyzer and hydrogen fuel cell manufacturing industry and prevent offshoring of manufacturing in line with federal policy.

### 1.2.3 | Actions to be taken by Industry and UCONN

Industry and academia will play a key role in developing the hydrogen workforce and supporting ecosystem development:

+ With regard to hydrogen infrastructure insurance, steps should be taken to ensure clear rules and policies for hydrogen infrastructure to support insurance industry workforce opportunities.
+ UCONN, working in collaboration with community colleges; vocational high schools; regional comprehensive universities; Workforce Investment Boards; trades with expertise in hydrogen technologies and relevant skillsets; labor-led workforce development programs and training programs; LDCs, EDCs, and other employers; and any other relevant workforce or training programs, should identify opportunities to support development of the hydrogen workforce and advance research and development in hydrogen electrolyzers and hydrogen fuel cells, and should identify resources and funding needs to implement and contribute to the development of a hydrogen roadmap led by DEEP.
+ UCONN should host a "learning laboratory" funded by the state which would include facilities (e.g., hydrogen production, hydrogen stations), and capabilities (e.g., fuel cell buses, stationary fuel cells) to host integrated technology demonstration projects, with the primary objective of addressing technical barriers to the deployment of fuel cells, hydrogen, and other clean energy technologies.
+ Eligible entities should pursue federal funding for manufacturing capabilities for electrolyzers and hydrogen fuel cells, to further advance development in the state.

3 As defined in the Inflation Reduction Act (2022) Sec. 13101.

# 2 | Background

## 2.1 | Special Act 22-8 Background and Motivation

House Bill No. 5200, "An Act Establishing a Task Force to Study Hydrogen Power," was introduced in the Connecticut House of Representatives in February of 2022.[4] The bill calls for the establishment of a Task Force composed of industry leaders, utilities, environmental advocates, and regulators to study the regulations and legislation needed to guide the development of hydrogen power, examine incentives and programs created by federal infrastructure legislation, and investigate sources for potential clean hydrogen power. The bill was sponsored by State Representatives David Arconti (D-109), Joseph Gresko (D-121), and Holly Cheeseman (R-37).[5]

## 2.2 | Special Act 22-8 Mandate

On May 23, 2022, the Senate and House of Representatives in General Assembly approved Special Act 22-8 establishing a Task Force to study hydrogen chaired by the Connecticut Green Bank. Special Act 22-8 mandates a study that must include, but is not limited to, the following items:

1. A review of regulations and legislation needed to guide the development and achievement of economies of scale for the hydrogen ecosystem in the state;
2. An examination of how to position the state to take advantage of competitive incentives and programs created by the federal Infrastructure Investment and Jobs Act;
3. Recommendations for workforce initiatives to prepare the state's workforce for hydrogen fueled energy-related jobs;
4. An examination of the sources of potential clean hydrogen, including, but not limited to, wind, solar, biogas and nuclear;
5. Recommendations for funding and tax preferences for building hydrogen-fueled energy facilities at brownfield sites through the Targeted Brownfield Development Loan Program;
6. Recommendations regarding funding sources for developing hydrogen fueled energy programs and infrastructure; and
7. Recommendations for potential end uses of hydrogen-fueled energy.

Per Special Act 22-8, the Task Force is required to submit a report on its findings and recommendations to the joint standing committee of the General Assembly and shall terminate on the date that it submits such report or January 15, 2023, whichever is later.

4 Connecticut General Assembly (2022), Connecticut House Bill 5200.
5 *Ibid.*

## 2.3 | Hydrogen Background

Hydrogen (H) is the simplest and most abundant element in the universe. Naturally occurring as two bonded H atoms ($H_2$), hydrogen is the lightest of all molecules. It is a colorless, odorless, and tasteless gas under standard conditions. On Earth, hydrogen is primarily bound within molecules of water or hydrocarbons. Most are familiar with hydrogen as paired with oxygen, forming $H_2O$, or water.

Hydrogen gas is a well-established and globally traded commodity. It is primarily used as an industrial feedstock or as an intermediate chemical feedstock in many industrial processes, such as oil refining, methanol production, and ammonia production for fertilizer. In addition, hydrogen can serve as a fuel or energy source.

Hydrogen has the highest energy density by mass of today's most-used fuels, including diesel, natural gas, and gasoline.[6] Since hydrogen has a very low volumetric density at ambient temperature, hydrogen energy is typically measured by weight in kilograms (kg) instead of by volume (as with natural gas). For example, 1 kg of hydrogen contains approximately the same energy as 1 gallon (2.8 kg) of gasoline.

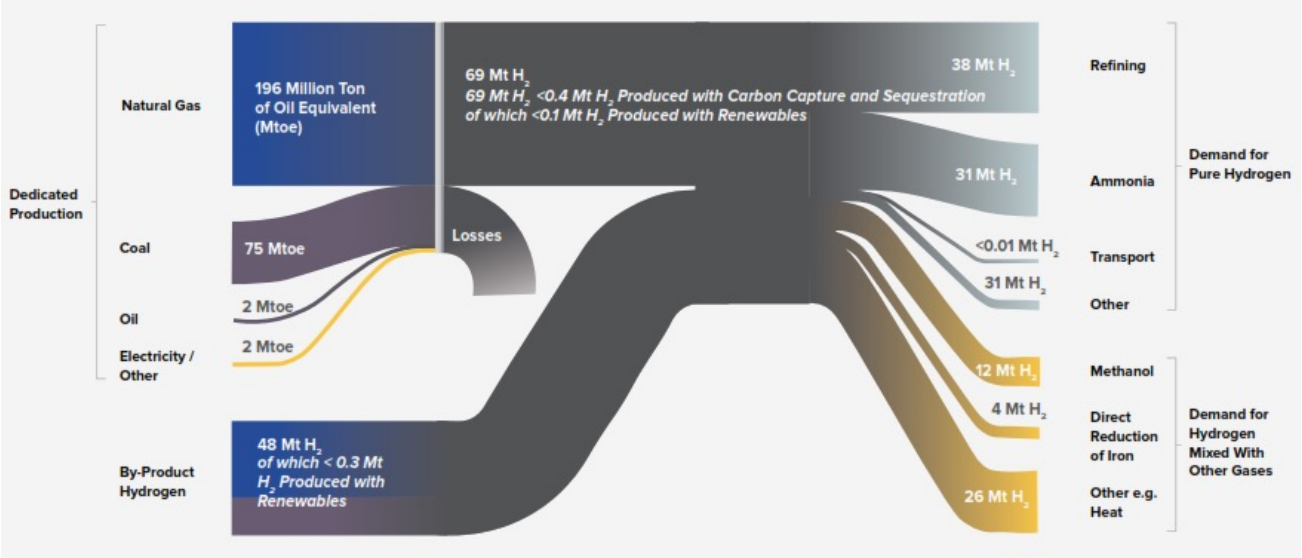
There are numerous ways to produce hydrogen but the carbon intensity of the hydrogen produced varies. Below is an overview of the most common methods for hydrogen production:

+ **Reformation:** Most hydrogen produced today in the United States is made via steam-methane reforming. In reformation, synthesis gas—a mixture of hydrogen, carbon monoxide, and a small amount of carbon dioxide—is created by reacting natural gas with high-temperature steam. The carbon monoxide is reacted with water to produce additional hydrogen. Natural gas reforming using steam accounts for the majority of hydrogen produced in the United States annually.
+ **Electrolysis:** Electrolysis is a method of using energy from an electric current to split a molecule into simpler components. The feedstock for electrolysis is water which gets split into the components oxygen and hydrogen. Electrolysis is accomplished using a commercially available device called an electrolyzer. In the process of electrolysis, the source of electricity generation utilized will contribute to the lifecycle carbon intensity of the hydrogen produced.
+ **Thermal Conversion/Gasification:** Thermal conversion, or gasification of organic matter, works by applying high heat and/or pressure on organic matter to transform the material from a solid state to a gaseous state. The resulting components of the process are mainly hydrogen, carbon monoxide, and carbon dioxide, which are further purified to produce hydrogen or methane that can be used for fuel. Organic matter can come from forestry waste, agricultural waste, organic municipal solid waste, or animal waste.

Currently, there is worldwide demand for about 70 million tonnes (Mt) of pure hydrogen, primarily for oil refining and ammonia production for fertilizers. Additionally, there is demand for 45 Mt of hydrogen gas mixtures, as fuel or feedstock, for processes including methanol production and steel production. The majority of dedicated hydrogen produced today is from fossil fuels, such as oil and natural gas. Less than 0.7% of current hydrogen production is from renewables or from fossil fuel plants equipped with carbon capture technology as demonstrated in Figure 1.[7]

6 Green Hydrogen Coalition (2022), Green Hydrogen Guidebook 2nd Edition.
7 International Energy Agency (2019), The Future of Hydrogen.

## FIGURE 1. HYDROGEN PRODUCTION SOURCES AND END USES




**Source:** International Energy Agency (2019), The Future of Hydrogen.

While hydrogen is a colorless gas, it has been given color codes such as green hydrogen, pink hydrogen, blue hydrogen, and so on to indicate the primary feedstocks, energy sources, and production processes used to produce the hydrogen. Figure 2 provides an illustrative example of a hydrogen color spectrum:

## FIGURE 2. THE COLORS OF HYDROGEN

| COLOR | PRIMARY FEEDSTOCK | PRIMARY ENERGY SOURCE | PRIMARY PRODUCTION PROCESS | Average Carbon Intensity $kgCO_2e/kgH_2$ |
|---|---|---|---|---|
| Brown | Coal or Lignite | Chemical Energy in Feedstock | Gasification & Reformation | 19 |
| Gray | Natural Gas | Chemical Energy in Feedstock | Gasification & Reformation | 10 |
| Blue | Coal, Lignite, or Natural Gas | Chemical Energy in Feedstock | Gasification with Carbon Capture and Sequestration | 1 - 5 |
| Pink | Water | Nuclear Power | Electrolysis | 0 |
| Green | Water | Renewable Electricity | Electrolysis | 0 |
| | Biomass or Biogas | Chemical Energy in Feedstock | Gasification, Reformation, & Thermal Conversion | |

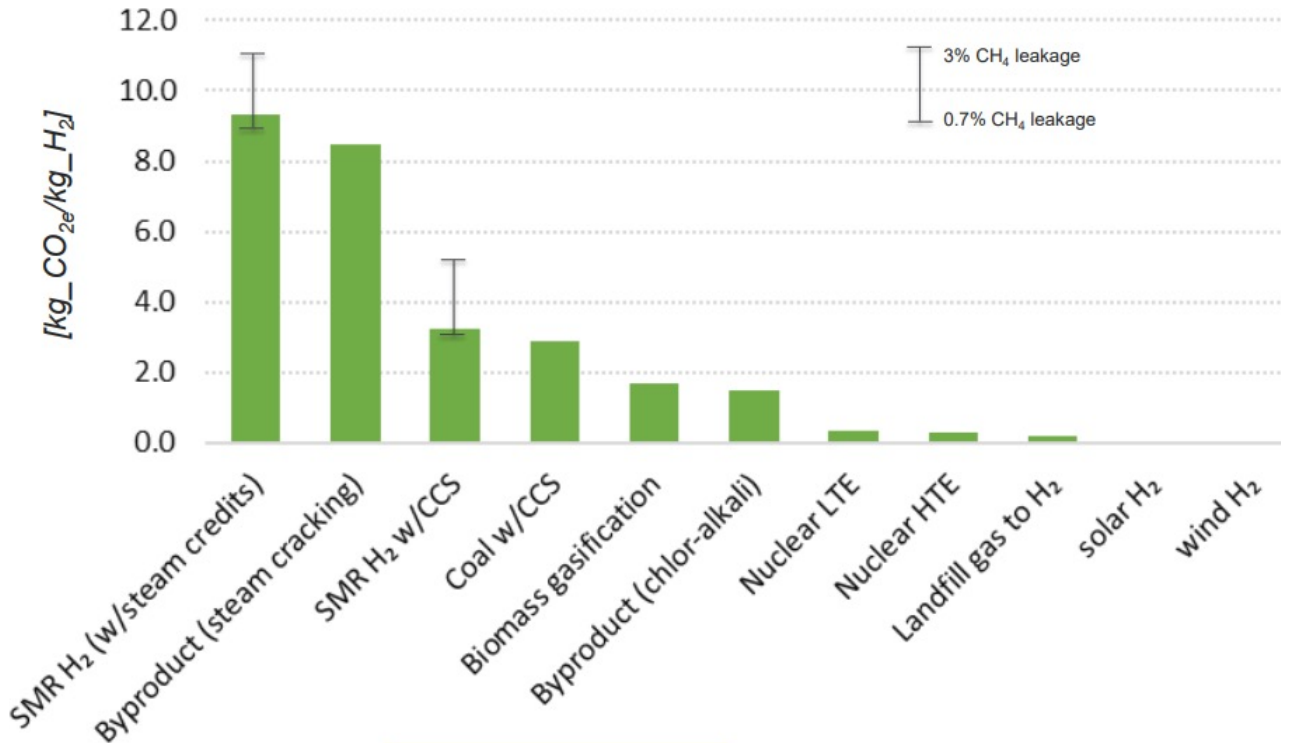
*NOTE: The carbon intensity of blue hydrogen is dependent on the efficiency of the carbon capture rate. The above carbon intensity range for blue hydrogen assumes a capture rate of 56% to 90%.*

**Source:** Green Hydrogen Coalition (2022), Green Hydrogen Guidebook.

There is growing interest in moving from color-coding hydrogen to a more quantifiable method. One such alternative is evaluating hydrogen based on its carbon intensity. Carbon intensity is defined as a fuel's life cycle greenhouse gas emissions per unit of fuel or energy delivered. This accounts for life cycle greenhouse gas emissions,[8] not just those that are emitted when the fuel is consumed. Hydrogen's carbon intensity can be measured in kilograms of $CO_2$ equivalent ($CO_2e$) per kilogram of hydrogen. For any quantity and type of greenhouse gas, $CO_2e$ signifies the amount of $CO_2$ that would have the equivalent global warming impact.

A study using the GREET model from Argonne National Laboratory identified the lifecycle carbon intensity associated with hydrogen production pathways. Clean hydrogen as defined by the Clean Hydrogen Production Standard can be produced by diverse feedstocks including nuclear, solar, wind, landfill gas, and even potentially fossil fuels with carbon capture and sequestration assuming minimal methane leakage as demonstrated by Figure 3.

**FIGURE 3. WELL-TO-GATE GHG EMISSIONS OF HYDROGEN PRODUCTION PATHWAYS**




**Source:** Argonne National Laboratory (2022), GREET Model for Hydrogen Life Cycle GHG Emissions.

8 The term "lifecycle greenhouse gas emissions" is defined by subparagraph (H) of section 211(o)(1) of the Clean Air Act (1955) (42 U.S.C. 7545(o)(1)). This term means the aggregate quantity of greenhouse gas emissions (including direct emissions and significant indirect emissions such as significant emissions from land use changes) related to the full fuel lifecycle, including all stages of fuel and feedstock production and distribution, from feedstock generation or extraction through the distribution and delivery and use of the finished fuel to the ultimate consumer, where the mass values for all greenhouse gases are adjusted to account for their relative global warming potential.

Defining hydrogen based on its carbon intensity provides a quantitative, technology-agnostic approach, as it only considers the life cycle emissions from the hydrogen source. As a result, the door is open for competition to flourish so long as the hydrogen production pathway in question can meet the desired life cycle emissions threshold. Federal guidance from the Infrastructure Investment and Jobs Act (IIJA) defines clean hydrogen as having a carbon intensity equal to or less than 2 kilograms CO2e/kg H2 produced at the site of production while the proposed Clean Hydrogen Production Standard defines clean hydrogen as that with less than 4 kg of CO2e/kg H2 on a lifecycle basis (well-to-gate).[9]

For the purpose of this report, clean hydrogen is defined as hydrogen with de minimis carbon emissions on a lifecycle basis. Further discussion on this topic is included in Section 4.2.1.

## 2.4 | Relevance of Action on Hydrogen

Economy-wide decarbonization is urgently needed to mitigate climate change and protect our communities' public health and infrastructure. To fully decarbonize energy systems, a clean molecule, such as clean hydrogen, will be required to replace fossil fuels in many applications.

Clean hydrogen can play a major role in eliminating harmful greenhouse gas (GHG) emissions across the global economy as a carbon-free form of fuel and energy storage, but the scale and decarbonization benefits provided by hydrogen will be determined by actions taken at the state level, including determining eligibility of different clean hydrogen production sources. Its versatility to provide heat, fuel, and power system services can help decarbonize multiple vital economic sectors, such as aviation fuel, maritime applications, heavy-duty trucking, and high-temperature industrial processes, among others.

Recent passage of federal legislation, particularly the IIJA and the IRA created a tipping point for domestic action on clean hydrogen. Specifically, the Regional Clean Hydrogen Hubs funding opportunity included in the IIJA spurred the development of regional partnerships to advance and incentivize clean hydrogen market development across the nation. In addition, there is an ever-increasing amount of policy related to hydrogen, and more specifically, clean hydrogen. In the last 3 years, approximately 120 hydrogen bills passed across the nation. Of these, about one third were specific to clean/renewable/green hydrogen.[10]

Notably, stakeholders raised concerns regarding hydrogen safety, end use prioritization, cost effectiveness, community impacts, emissions intensity, and compatibility with state climate goals. The findings and recommendations presented by the Task Force provide a basis for Connecticut to begin to develop a clean hydrogen economy while addressing key stakeholder concerns.

9 US Department of Energy (2022), Clean Hydrogen Production Standard Draft Guidance and United States Congress (2021), H.R.3684 – Infrastructure Investment and Jobs Act.

10 Strategen Consulting analysis.

## 2.5 | Inclusion of Hydrogen in the 2022 Comprehensive Energy Strategy

The Comprehensive Energy Strategy (CES), developed DEEP examines future energy needs in the state and identifies opportunities to reduce costs for ratepayers, ensure reliable energy availability, and mitigate public health and environmental impacts of Connecticut's energy use, such as GHG emissions and emissions of criteria air pollutants.[11] Under Section 16a-3d of the Connecticut General Statutes, DEEP is charged with preparing a CES every four years.[12] In planning for effective management of Connecticut's energy system – including electricity, heating, cooling, and fuels used for transportation – the CES provides recommendations for legislative and administrative actions that will aid in the achievement of interrelated environmental, economic, security, and reliability goals.

The 2022 Comprehensive Energy Strategy will build on and/or potentially modify findings and recommendations of prior Comprehensive Energy Strategies released in 2013 and 2018 and will also consider emerging issues and recommendations that may not have been addressed in prior years. Further, Governor Lamont's Executive Order 21-3 directs DEEP to include in the next CES a set of strategies to: (1) provide for more affordable heating and cooling for Connecticut residents and businesses, (2) achieve reductions in GHG emissions from residential buildings and industrial facilities as needed to enable the state to meet the economy-wide GHG reduction targets for 2030 and 2050 established in the Global Warming Solutions Act, and (3) improve the resilience of the state's energy sector to extreme weather events, fuel commodity price spikes, and other disruptions.[13]

On February 17, 2022, DEEP held a scoping meeting to seek public input on the scope of topics that the CES will focus on.[14] Among the topics included in DEEP's draft CES scope was emerging technologies and the role they can provide in meeting Connecticut's climate goals and resource adequacy; including, but not limited to, clean hydrogen.[15] In addition, on April 6, 2022, DEEP held a virtual Hydrogen Technical Meeting regarding the incorporation of a strategy for hydrogen development into the 2022 CES.[16] DEEP also held a technical session on alternative fuels (including hydrogen) for the CES on November 4, 2022.[17] The inclusion of hydrogen in the 2022 CES recognizes the role that hydrogen is expected to play in Connecticut's decarbonized future and provides signals for further regulatory and legislative action over the next several years to further advance the hydrogen economy.

The activities of the Hydrogen Power Study Task Force are separate from DEEP's Comprehensive Energy Strategy Process, but it is expected that the findings and recommendations provided by the Task Force will be informative for DEEP's processes related to hydrogen.

11 Connecticut DEEP, Comprehensive Energy Strategy.
12 Connecticut Gen. Stat. §16a-3d.
13 Connecticut Legislature (2021), Executive Order 21-3.
14 Connecticut DEEP (2022), 2022 Comprehensive Energy Strategy Scoping Meeting.
15 Connecticut DEEP (2022), Notice of Technical Meeting and Request for Written Comment on Hydrogen Opportunities.
16 *Ibid*.
17 Connecticut DEEP (2022), CT 2022 Comprehensive Energy Strategy Technical Session 6: Alternative Fuels.

## 2.6 | Connecticut Regional Hub Participation

Connecticut joined New York, New Jersey, Maine, Rhode Island, New Hampshire, and Massachusetts to develop a proposal to become one of at least four regional clean hydrogen hubs designated through the IIJA Regional Clean Hydrogen Hubs program. If selected, the hub will receive from $400 million to $1.25 billion to develop and deploy a hydrogen hub in the northeast region within an eight to twelve year timeframe. The New York State Energy Research & Development Authority (NYSERDA) leads the effort, and Connecticut represents the gateway to New England as well as a key segment of the I-95 corridor. As part of the multi-state collaboration, DEEP is partnering with Connecticut entities representing the entire chain of hydrogen producers, end users, technology and equipment manufacturers; utilities; and the research and development community including university leaders. These partners are expected to work together to accomplish the following:[18]

+ Define the shared vision and plans for the regional hydrogen hub that can advance safe clean hydrogen energy innovation and investment to address climate change, while improving the health, resiliency, and economic development of the region's residents.
+ Perform research and analysis necessary to support the hub proposal and align on an approach to quantifying greenhouse gas emissions reductions as a result of deploying this technology.
+ Develop a framework to ensure the ecosystem for innovation, production, infrastructure, and related workforce development is shared across all partner states.
+ Support environmentally responsible opportunities to develop hydrogen, in accordance with participating states' policies.

The activities of the Task Force are separate from Connecticut's participation in the Regional Clean Hydrogen Hubs, but it is expected that the recommendations provided by the Task Force will provide support for regional hydrogen market development and set Connecticut to become a leader in the hydrogen ecosystem.

18 Office of Governor Ned Lamont (2022), Governor Lamont Announces Connecticut Partners with New York, New Jersey, and Massachusetts to Develop Regional Clean Hydrogen Hub Proposal.

# 3 | Process

## 3.1 | Task Force Composition and Nomination Process

Special Act 22-8 established the Task Force and dictated its composition. The act designated five (5) specific Task Force members and provided assignments to members of the Senate and House of Representatives to nominate sixteen (16) additional Task Force members. According to Special Act 22-8, the Task Force would consist of the following:

+ The president of the Connecticut Green Bank, who shall be the chairperson of the Task Force;
+ Two representatives from the electricity division of an electric distribution company that has a service area of eighteen or more cities and towns, one of whom shall be appointed by the speaker of the House of Representatives and one of whom shall be appointed by the minority leader of the House of Representatives;
+ Two representatives from the electricity division of an electric distribution company that has a service area of not more than seventeen cities and towns, one of whom shall be appointed by the president pro tempore of the Senate and one of whom shall be appointed by the minority leader of the Senate;
+ A representative from the gas division of an electric distribution company that has a service area of eighteen or more cities and towns, who shall be appointed by the majority leader of the House of Representatives;
+ A representative from the gas division of an electric distribution company that has a service area of not more than seventeen cities and towns, who shall be appointed by the minority leader of the Senate;
+ A representative from an eligible nuclear power generating facility, as defined in section 16a-3m of the general statutes, who shall be appointed by the minority leader of the House of Representatives;
+ A representative of the building trades, who shall be appointed by the majority leader of the Senate;
+ Three representatives of Connecticut manufacturers of hydrogen fueled energy technology, one of whom shall be appointed by the speaker of the House of Representatives, one of whom shall be appointed by the president pro tempore of the Senate and one of whom shall be appointed by the minority leader of the House of Representatives;
+ Three representatives of environmental organizations that advocate for renewable energy, one of whom shall be appointed by the president pro tempore of the Senate, one of whom shall be appointed by the majority leader of the House of Representatives and one of whom shall be appointed by the minority leader of the Senate;
+ Two members of the Connecticut Hydrogen-Fuel Cell Coalition, one of whom shall be appointed by the majority leader of the House of Representatives and one of whom shall be appointed by the minority leader of the Senate;
+ The chairperson of the Public Utilities Regulatory Authority, or the chairperson's designee;
+ The Commissioner of Energy and Environmental Protection, or the commissioner's designee;
+ The president of The University of Connecticut, or the president's designee; and
+ The director of energy initiative at the Connecticut Center of Advanced Technology (CCAT).

Fourteen out of sixteen Task Force members were nominated and approved by the Senate and the House of Representatives. The final composition of the Task Force is as follows:

## TABLE 1. TASK FORCE APPOINTEES

| Appointer | Name | Title and Organization |
|---|---|---|
| **Ex Officio** | Katie Dykes | Commissioner, DEEP |
| **Ex Officio** | Marissa Gillett | Chairwoman, PURA |
| **Ex Officio** | Radenka Maric | President, UCONN |
| **Ex Officio** | Joel Rinebold | Director, CCAT |
| **Ex Officio (Chair)** | Bryan Garcia | President & CEO, Connecticut Green Bank |
| **Ex Officio (Co-Chair)** | Sara Harari | Associate Director of Innovation & Advisor to the President & CEO, Connecticut Green Bank |
| **President Pro Tempore** | Enrique Bosch | Director of Innovation, Avangrid |
| | Sridhar Kanuri | Chief Technology Officer, HyAxiom |
| | Shannon Laun | Vice President & Director, Conservation Law Foundation |
| **Majority Leader Senate** | Keith Brothers | Business Manager & Secretary Treasurer, AFL-CIO |
| **Minority Leader Senate** | Adolfo Rivera | Senior Director, Avangrid |
| | Frank Reynolds | President & CEO, Avangrid |
| | Unfilled | Environmental Advocate |
| | Unfilled | Connecticut Hydrogen Fuel Cell Coalition Representative |
| **Speaker of the House** | Digaunto Chatterjee | Vice President of System Planning, Eversource |
| | Katherine Ayers | Vice President of Research & Development, Nel Hydrogen |
| **Majority Leader House** | Nikki Bruno | Vice President of Clean Technologies, Eversource |
| | Samantha Dynowski | State Director, Sierra Club |
| | Anthony Leo | Vice President & CTO, Fuel Cell Energy |
| **Minority Leader House** | Jennifer Schilling | Vice President of Grid Modernization, Eversource |
| | Mary Nuara | State Policy Director, Dominion Energy |
| | William Smith | President & CEO, Infinity Fuel Cell |

## 3.2 | Technical Consultant Support

Strategen was selected via a competitive RFP per the operating procedures of the Connecticut Green Bank to provide administrative support and technical expertise on behalf of the Task Force and its Working Groups.[19] The funding source for this engagement was directed by the Connecticut General Assembly through the passage of Special Act 22-8 with funds from the Renewable Energy Investment Fund.[20] Strategen led research functions associated with the undertaking of the numerated tasks in Special Act 22-8; convened and facilitated stakeholder forums, including Task Forces and Working Groups; and providing support as needed to the administrative functions (e.g., notes, minutes, plans) of the Task Force, and its Working Groups.

Strategen is a globally connected, impact-driven firm on a mission to decarbonize energy systems. Strategen is a minority and woman-owned business headquartered in Berkeley, California with offices in Portland, Oregon and Brisbane, Australia. Since 2005, Strategen's 60-person multidisciplinary team of economists, business strategists, regulatory and policy experts and energy modelers has helped clients envision, accelerate, and create a clean energy future.

## 3.3 | Task Force Meetings

The Task Force was convened on the second Tuesday of the month from July 2022 to January 2023. These meetings were noticed with the Secretary of State and were open for public participation with a dedicated public comment section at the close of each meeting occurrence. Agendas, meeting minutes, slides, and recordings were publicly posted on the Connecticut Green Bank's Hydrogen Task Force website and meeting minutes were additionally translated into Spanish to promote transparency and accessibility.[21]

The objectives of the Task Force meetings were multifaceted. These meetings were intended to:

+ **Educate** – Task Force members and the public were informed about leading scientific perspectives and market development related to clean hydrogen via presentations from industry experts such as the Green Hydrogen Coalition and national laboratories such as Sandia National Lab and the Lawrence Berkeley National Lab.
+ **Engage** – Task Force members were offered opportunities to participate in showcase tours of hydrogen-related facilities around the state including the University of Connecticut's Innovation Partnership Building, FuelCell Energy, Nel Hydrogen, Dominion Millstone, and HyAxiom to see first-hand how Connecticut is contributing to the hydrogen economy.
+ **Enable** – Task Force meetings provided Task Force members with the knowledge and collaborative atmosphere to develop findings and make recommendations for inclusion within the legislative report.
+ **Emphasize Environmental Justice** – Critical voices from the Bridgeport Regional Energy Partnership and the Connecticut Roundtable on Climate and Jobs were elevated for Task Force attention to both inform the Task Force and empower critical stakeholders to enable the development of recommendations that considered community engagement.

19 Connecticut Green Bank (2021), Operating Procedures Pursuant to Section 16-245n of the Connecticut General Statutes.
20 Per Conn. Gen. Stat. 16-245n(a), "clean energy" includes "hydrogen production and hydrogen conversion technologies."
21 Connecticut Green Bank (2022), Hydrogen Power Study Task Force.

## THE UNIVERSITY OF CONNECTICUT'S HYDROGEN INNOVATION AND RESEARCH

**LOCATION:** Storrs, Connecticut

**FACILITY:** The Innovation Partnership Building is a premier center for cutting edge research and industry collaboration and innovation. The IPB provides an ecosystem that inspires great ideas, pushing the envelope for next generation solutions. Cross-disciplinary research teams develop novel approaches to critical real-world problems in fields ranging from manufacturing and biomedical devices to cybersecurity and sustainable energy.

**TYPE:** Education and Research

**FACULTY & STAFF:** 8,646 Full-Time Faculty and Staff

**STUDENTS:** 32,146 Students (i.e., 23,837 Undergraduate Students; 8,309 Graduate and Professional Students)

**PARTNERSHIP:** On October 20, 2022, UCONN initiated a partnership with the National Renewable Energy Laboratory (NREL) for research and innovation to leverage scientific collaboration to research new renewable energy technologies at the IPB. UCONN is one of five research universities including MIT, Princeton, Georgia Tech, and Carnegie Mellon to collaborate with NREL in the eastern United States.

**FUN FACT:** UCONN President Radenka Maric is the Connecticut Clean Energy Fund (predecessor to Connecticut Green Bank) Professor in Sustainable Energy with her expertise in proton exchange and alkaline fuel cells, and water-gas shift reforming reactions.

UCONN

# 3.4 | Working Group Process

The efforts of the Task Force were supported by five Working Groups – Sources, Uses, Infrastructure, Funding, and Policy and Workforce Development – whose objectives were to develop findings and recommendations to be brought before the Task Force in response to the Special Act 22-8 mandate. These Working Groups were led by Task Force appointed co-chairs and coordinated and supported by Strategen.

### FIGURE 4. OVERVIEW OF TASK FORCE WORKING GROUPS

| Policy & Workforce Development | Funding | Hydrogen Sources | Hydrogen Infrastructure | Hydrogen Uses |
|---|---|---|---|---|
| **CHAIRED BY:** Commissioner Katie Dykes, DEEP; Chairman Marissa Gillett, PURA | **CHAIRED BY:** Commissioner Katie Dykes, DEEP; Commissioner Alexandra Daum, DECD | **CHAIRED BY:** Ugur Pasaogullari, UCONN; Kathy Ayers, Nel Hydrogen | **CHAIRED BY:** Adolfo Rivera, Avangrid; Chris Capuano, Nel Hydrogen | **CHAIRED BY:** Joel Rinebold, CCAT; Digaunto Chatterjee, Eversource; Frank Reynolds, Avangrid |
| Will identify legislation and workforce initiatives needed to guide the development of clean hydrogen. | Will identify funding sources for developing hydrogen-fueled energy programs and infrastructure. | Will identify potential sources of clean hydrogen and relative merits. | Will identify infrastructure needed to support scaled and cost-effective hydrogen economy. | Will identify potential and priority end uses for hydrogen. |

Working Group meetings were held monthly from September to December 2022. These meetings were open to the public and stakeholder participation was encouraged.[22]

22 Connecticut Green Bank (2022), Hydrogen Power Study Task Force Working Groups.

### 3.4.1 | Sources Working Group

The Sources Working Group was co-chaired by Kathy Ayers, the Vice President of Research and Development at Nel Hydrogen and Professor Ugur Pasaogullari from the University of Connecticut. The objective of the Hydrogen Sources Working Group was to examine the sources of potential clean hydrogen in Connecticut including, but not limited to, wind, solar, biogas and nuclear. This included an assessment of the maximum in-state clean hydrogen production that could be achieved using Connecticut's share of carbon-neutral feedstocks, while factoring in potential needs for these types of resources in other segments of a decarbonized economy. This analysis was also coordinated with forecasts of clean hydrogen demand developed by the Uses Working Group to assess any gaps in the state's clean hydrogen production capacity and its projected hydrogen use.

### 3.4.2 | Uses Working Group

The Uses Working Group was co-chaired by Digaunto Chatterjee, the Vice President of System Planning at Eversource, Frank Reynolds, the President and CEO of Avangrid, and Joel Rinebold, the Director of Energy at CCAT. The objective of the Hydrogen Uses Working Group was to provide recommendations for potential end uses of hydrogen-fueled energy to promote achievement of Connecticut's decarbonization goals. This included a cross-sectoral assessment of the areas where clean hydrogen use will be most viable in the future, coupled with analysis of the potential demand from the identified end uses. In addition to a forecast for overall hydrogen demand, the Uses Working Group also considered the geographic location of end users and their proximity to potential sources of hydrogen production.

### 3.4.3 | Infrastructure Working Group

The Infrastructure Working Group was co-chaired by Chris Capuano, the Director of Contract R&D Programs at Nel Hydrogen, and Adolfo Rivera, the Senior Director of Green Hydrogen at Avangrid. The Infrastructure Working Group developed insights into infrastructure requirements to meet projected clean hydrogen demand and assessed existing infrastructure that could be repurposed to meet this demand. This included developing an understanding of hydrogen transportation and storage needs and identifying opportunities and barriers to developing this infrastructure in Connecticut. The Infrastructure Working Group also considered the potential for strategic partnerships with neighboring states to enhance infrastructure development for a regional clean hydrogen ecosystem.

### 3.4.4 | Funding Working Group

The Funding Working Group was co-chaired by Commissioner Alexandra Daum from DECD and Commissioner Katie Dykes from DEEP. The objective of the Funding Working Group was to review existing hydrogen funding mechanisms and incentives, such as those in the Infrastructure Investment and Jobs Act (IIJA) and determine how Connecticut could be best positioned to participate in these programs and potentially develop new opportunities. The Funding Working Group also recommended additional funding sources for developing a hydrogen ecosystem with a focus on the Targeted Brownfield Development Loan Program.

### 3.4.5 | Policy and Workforce Development Working Group

The Policy and Workforce Development Working Group was co-chaired by Commissioner Katie Dykes from DEEP and Chairwoman Marissa Gillett from PURA. The objective of the Policy and Workforce Development Working Group was to review the Connecticut policy and regulatory landscape to determine gaps that need to be addressed to promote development of a clean hydrogen ecosystem. The Policy and Workforce Development Working Group also worked with local industry experts to develop recommendations regarding workforce initiatives and policy developments based on best practices that can help support a hydrogen ecosystem.

## 3.5 | Transparency, Engagement, and Outreach

The Task Force recognized the critical importance of process transparency and dedicated engagement and outreach efforts to enable robust public participation and ensure that diverse stakeholder perspectives are represented and reflected in the final legislative report to the Energy and Technology Committee.

To that end, all Task Force and Working Group meetings were noticed with the Secretary of State and were open for public participation with several opportunities for discussion and comments. Agendas, meeting minutes, slides, and recordings were publicly posted on the Connecticut Green Bank's Hydrogen Task Force website and meeting minutes were translated into Spanish to promote transparency and accessibility.[23] Further, dedicated marketing materials for each Task Force meeting were developed and Task Force members were encouraged to publicize meeting occurrences with their network.[24] In addition, the Green Bank and its consultant promoted the activities of the Task Force at DEEP's Comprehensive Energy Strategy Technical Session hosted on November 4, 2022.[25]

As findings and recommendations were being developed, the Green Bank issued a Request for Written Comment to publicly capture stakeholder feedback.[26] Stakeholder comments have been incorporated into this legislative report. Finally, the Green Bank and its consultant hosted a public listening session on December 8, 2022, to provide further opportunity for open stakeholder feedback to inform the activities of the Task Force.[27] In addition to an overview of Special Act 22-8, this webinar included a summary of the Task Force's process and key findings, as well as ample time to field public comments. The Request for Written Comments and Notice of this public listening session were shared with the Green Bank's listserv to increase engagement.

It should be noted that the efforts of the Task Force and associated Working Groups are not intended to replace the stakeholder engagement process used to develop and vet updates to state policy; rather, these efforts are intended to surface new ideas for consideration regarding how to develop a clean hydrogen economy in Connecticut.

23 Connecticut Green Bank (2022), Hydrogen Power Study Task Force.
24 For example, see the October Task Force meeting flyer.
25 Connecticut DEEP, CES Technical Meeting 6 Recording.
26 Connecticut Green Bank (2022), Special Act 22-8 Public Request for Written Comments.
27 Connecticut Green Bank (2022), Hydrogen Study Task Force Webinar and Listening Session.

# 4 | Findings and Recommendations

This section includes both the findings and recommendations developed during the Task Force process. For this report, findings were considered research, analysis, or other fact base critical to understanding opportunities and the best path forward for Connecticut. Recommendations are the interpretation and application of those findings to Connecticut, including specific actions that might be taken by various state organizations to achieve the objectives laid out by Special Act 22-8. Recommendations also represent areas of consensus from Task Force and Working Group participants, but additional perspective from the stakeholder process, including minority opinions, caveats, concerns, suggestions, or areas of interest, are represented in dedicated sections on stakeholder feedback.

## 4.1 | Findings and Recommendations by Special Act Task

The following subsections align directly with the directives assigned from the Special Act 22-8 mandate and provide a description of key findings, recommendations, and stakeholder feedback.

### 4.1.1 | A review of regulations and legislation needed to guide the development and achievement of economies of scale for the hydrogen ecosystem in the state.

#### 4.1.1.1 | Findings

Connecticut has existing policies intended to enable decarbonization, which provide ecosystem support for the development of clean hydrogen to contribute to the state's climate goals. For example, Connecticut General Statute 22a-200a. mandates statewide greenhouse gas emission reduction targets across all sectors,[28] while Public Act 22-5 also requires reductions specific to the electric sector, including a 100% zero emissions electric supply by 2040.[29] This is supported by Connecticut's Renewable Portfolio Standard (RPS), which sets annual targets for shares of electric generation from renewable energy sources, reaching 48% by 2030.[30] Additionally, Connecticut has set limits for NOx emissions from fuel-burning equipment at stationary sources[31] and is part of the multi-state zero emission medium- and heavy-duty vehicle (MHDV) memorandum of understanding, which sets goals for 30% of all new MHDV sales to be zero emissions by 2030 and 100% by 2050.[32]

Connecticut also has several existing policies or programs that explicitly mention the inclusion of hydrogen and fuel cells, including, but not limited to:

+ **Special Act 22-8 (2022)** establishes the Hydrogen Power Study Task Force. The express goal of the Special Act is to "study hydrogen-fueled energy in the state's economy and energy infrastructure."[33]
+ **Conn. Gen. Stat. 16-244z. (2022)** procurement plans for electric distribution companies and implements a set of renewable energy tariffs.[34]
+ **Conn. Gen. Stat. 31-53d. (2021)** states that a developer of a 2 MW or greater Class I renewable energy project shall take all reasonable actions to ensure that a community benefits agreement is entered into and take appropriate actions to ensure a workforce development program is established.[35] In Connecticut, fuel cells are included as a Class I renewable resource.

28 Connecticut General Assembly (2022), Connecticut General Statute 22a-200a.
29 Connecticut General Assembly (2022), Connecticut Public Act No. 22-5.
30 Separate portfolio standards are set for resources designated as Class I, Class II, and Class III as per the Renewable Portfolio Standard.
31 Connecticut Agencies Regulations §22a-174-22f (2016.
32 Multi-State Medium- and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding, (2020).
33 Connecticut General Assembly (2022), Special Act 22-8.
34 Connecticut Gen Stat §16-244z.
35 Connecticut Gen Stat §31-53d.

+ **Executive Order 21-3 (2021)** directs DEEP to include in the next Comprehensive Energy Strategy, a set of strategies to: (1) provide for more affordable heating and cooling; (2) achieve reductions in GHG emissions from residential buildings and industrial facilities; and (3) improve the resilience of the state's energy sector.[36]
+ **Conn. Gen. Stat. 22a-202 (2020)** establishes the CT DEEP Connecticut Hydrogen and Electric Automobile Purchase Rebate (CHEAPR) program, which provides support for zero emissions vehicles and hydrogen refueling, including passenger vehicles.[37]
+ **The 2020 Integrated Resource Plan (2020)** discusses clean hydrogen as a strategy to reduce electric system emissions.[38]
+ **Conn. Gen. Stat. 16-244y (2018)** sets a competitive process for electric distribution companies (EDCs) to acquire new fuel cell electricity generation projects with preference given to projects that (1) use equipment manufactured in Connecticut; or (2) make use of existing sites and supply infrastructure.[39]
+ **Conn. Gen. Stat. 16a-3f through h (2018)** states that the DEEP commissioner may solicit proposals from providers of Class I renewable resources, including fuel cells, to provide a certain percent of EDC load.[40]
+ **Conn. Gen. Stat. 16-244x (2016)** establishes a pilot program to support the development of shared clean energy facilities[41]
+ **Conn. Gen. Stat. 13b-38dd (2009)** directs the development of a zero-emissions buses implementation plan.[42]

While the policies and programs mentioned above demonstrate that Connecticut is working to create the ecosystem needed to support a robust clean hydrogen economy, there is opportunity for further policy development or strengthening of existing policy commitments.

#### 4.1.1.2 | Recommendations

Additional policies, programs, funding, and other policy instruments could be established to provide clearer guidance for Connecticut's hydrogen deployment and long-term vision. Best practices and lessons learned from other jurisdictions offer a portfolio of potential actions that could be modified and applied in Connecticut, as appropriate.

The Policy and Workforce Development Working Group developed a set of policy guiding principles to align research and recommendations with existing state policy and processes related to clean hydrogen. These guiding principles stipulate that all final recommendations should:

1. Be in compliance with relevant state statutes and regulations, or identify changes that would enable compliance;
2. Align with state policy and active regulatory proceedings;
3. Identify any fundamental underlying policy or regulatory challenges, and/or potential enablers;
4. Identify expected impacts to active policy proceedings; and
5. Identify or recommend relevant regulatory stakeholder proceedings that could be used to allow for additional review and vetting or identify the need for new procedural avenues.

36 Connecticut Government (2021), Executive Order 21-3.
37 Connecticut Gen. Stat. § 22a-202.
38 Connecticut DEEP (2021), 2020 Connecticut Integrated Resources Plan.
39 Connecticut Gen. Stat. §16-244y.
40 Connecticut Gen. Stat. §16a-3f through h.
41 Connecticut Gen Stat §16-244x.
42 Connecticut Gen. Stat. §13b-38dd.

The policy guiding principles informed the development of potential policy recommendations and could be employed to guide further policy development in the state.

To guide the development of and achievement of economies of scale for a hydrogen ecosystem in the state, Connecticut should evaluate the applicability of best practices and lessons learned from other jurisdictions for modification in the Connecticut context. Based on an analysis of national hydrogen policy, Connecticut should consider the following enabling policy actions that would support hydrogen development and deployment across all end use applications:

+ **DEEP should conduct further investigation to ultimately establish a definition of clean hydrogen that would be most appropriate for Connecticut.** While hydrogen can be produced from fossil fuels via steam methane reformation, from electricity via electrolysis, or from organic sources, these sources have differing levels of GHG emissions associated with production. Many countries and states have established definitions of clean, green, renewable, or low-carbon hydrogen to differentiate hydrogen with lower GHG emissions intensity (as seen in Table 5) and the federal government has similarly suggested a definition based on life cycle emissions. Such definitions can provide clarity for hydrogen development within the state and will help to guide project and fuel eligibility for siting, funding, tariff regulation, and other actions and initiatives referenced in this report.
+ **DEEP should clarify and work with relevant agencies and stakeholders to explore the acceleration of permitting for clean hydrogen infrastructure, while ensuring appropriate guardrails to avoid unintended adverse impacts.** To scale development at the speed needed to transition to a clean economy, it is important to ensure that permitting requirements are transparent and readily understood by all stakeholders. An example of work that supports this goal is the Governor's Office of Business and Economic Development in California, which published the "Hydrogen Station Permitting Guidebook" with the explicit goal of streamlining the permitting process.[43] In addition to permitting, statutory authorization to build infrastructure, including that of LDCs, should be addressed to ensure coordinated and regulated build-out.
+ **DEEP should solicit feedback and guidance from the Connecticut Equity and Environmental Justice Advisory Council (CEEJAC) to advance community impact, environmental justice, and energy equity discussions on hydrogen and to support the development of a framework that outlines both a vision and goals for Connecticut's clean hydrogen policies.** In California, community impacts have been taken into account through the creation of advisory boards and other programs through state agencies, including the California Air Resources Board (CARB).[44,45] Engaging with communities, especially those that have been disadvantaged or underrepresented, is a critical step in ensuring the transition to a clean economy is one that is inclusive, just, and sustainable.

43 California Governor's Office of Business and Economic Development (2020), Hydrogen Station Permitting Guidebook.
44 California Air Resources Board, Environmental Justice Advisory Committee.
45 California Public Utilities Commission, Disadvantaged Communities Advisory Group.

+ **DEEP should lead interstate and interagency coordination to develop a hydrogen roadmap and strategy that identifies hydrogen supply and demand scenarios; approaches to a clean hydrogen backbone to enable cost-effective scaled transport; and other research and infrastructure investment opportunities to inform policy development and funding and RD&D strategy, in consultation with ecosystem stakeholders.** With the announcement of the DOE's Regional Clean Hydrogen Hubs program (H2Hubs), it will be essential for Connecticut to have interagency and regional collaboration to effectively compete for the $8 billion available for regional clean hydrogen hubs.[46] DEEP should work with other state agencies in Connecticut and in coordination with other states in the region. Connecticut can look to the DOE's National Clean Hydrogen Strategy and Roadmap as a guide, and then use a similar or adapted methodology at the state level. Similarly, Connecticut can consider state reports, like the Oregon Department of Energy's renewable hydrogen report that seeks to identify where renewable hydrogen can be most useful in its decarbonizing economy. Connecticut's vision can build on work done and input provided to the Task Force, and ideally would include an examination of the following factors:
  - Current technologies available for hydrogen transport
  - The role of hydrogen transport costs in overall delivered cost
  - Cost and funding mechanisms for any enabling infrastructure and clean hydrogen production
  - The cost and availability of zero-carbon renewable energy resources to produce clean hydrogen via electrolysis
  - Alignment with state policies and goals
  - Alignment with regional hub activities
  - Stakeholder feedback, and especially community preferences
+ **State agencies should identify appropriate leads to coordinate on hydrogen safety with local and federal organizations to allow for alignment and clear flow of best practices, policy developments, trainings, and certifications.** Connecticut can consider adopting and/or developing codes and standards to ensure safe operation, handling, and use of hydrogen and hydrogen systems. Jurisdictions could also consider (1) benchmarking existing testing for safe hydrogen sensors that detect leaks and monitor hydrogen purity and (2) developing codes and standards for buildings and equipment in commercial, industrial, and transport applications, if not already in place. To this end, Connecticut can look to the federal code and standards set by the DOE to inform processes.[47]

Further, Connecticut should consider the following enabling policy actions that would provide targeted support for the highest priority end use applications identified by the Uses Working Group, as discussed in Section 4.1.7.

+ **DEEP should explore market-based approaches to incent reductions in the carbon intensity of fuels for mobility end use applications.** For example, the California Air Resources Board (CARB) has established a Low Carbon Fuels Standard (LCFS), which aims to lower the lifecycle intensity of the transportation sector using a carbon crediting system.[48] This program additionally includes a provision that covers Hydrogen Refueling Infrastructure.[49] In Connecticut, ensuring that fuel reduction measures are applicable to medium- and heavy-duty vehicles will be integral for supporting the use of hydrogen in this hard-to-decarbonize and high priority category.[50]

46 United States Department of Energy Office of Clean Energy Demonstrations, Regional Clean Hydrogen Hubs.
47 United States Department of Energy, Hydrogen Program Codes and Standards.
48 California Air Resources Board (2020), Low Carbon Fuel Standard.
49 California Air Resources Board, LCFS ZEV Infrastructure Crediting.
50 The medium- and heavy-duty category includes vehicles with various use-cases, some of which may be more appropriate for electrification, while others, such as long-haul heavy-duty trucking, are more difficult to electrify and are therefore more challenging to decarbonize.

+ **DEEP should identify and potentially expand clean transportation incentives to include on-site port handling equipment, harbor crafts, and ocean-going vessels, in collaboration with other state and federal agencies.** California, through CARB, lists a variety of funding opportunities for clean commercial harbor craft and equipment.[51] One notable funding opportunity, hosted by the California Energy Commission, awards up to $12.6 million for demonstration projects of hydrogen fuel cell systems and hydrogen fueling infrastructure for commercial harbor craft, with the goal of "advance[ing] technologies that can enable ports as high throughput clusters for low-cost and low-carbon hydrogen and achieve scaled demand across multiple applications."[52] Launching similar funding opportunities can help send strong market signals to ensure hydrogen can be integral to decarbonizing these hard-to-decarbonize sectors.
+ **The Legislature should evaluate broader policies that would facilitate the decarbonization of hard-to-electrify sectors, including long-haul heavy-duty trucking, aviation, shipping, and industrial processes.** For example, in California the legislature has a net-zero GHG emissions mandate by 2045. To support the achievement of this mandate, California's legislature passed Assembly Bill 1322, which would require the CARB to develop and implement a plan to reduce GHG emissions associated with aviation, including a sustainable fuels target for the aviation sector of at least 20% by 2030.[53] Within this bill, hydrogen is included as a sustainable fuel. Although Bill 1322 was ultimately not signed by California's governor, it nonetheless provides an example of potential measures to establish sector-specific targets to help facilitate the decarbonization of hard-to-electrify sectors where hydrogen can play an integral role.
+ **The Legislature should consider tax exemptions for hydrogen vehicles and critical facilities that produce or use clean hydrogen.** By making hydrogen or fuel cell vehicles exempt from state taxes, the price of these vehicles becomes more cost-competitive with other vehicle types and can thereby generate market momentum. For example, the State of Washington, via its Department of Revenue, implemented a sales and use tax exemption for fuel cell vehicles as of July 2022.[54] Connecticut could also explore implementing a similar tax exemption through its Department of Revenue Services. A recent, and unprecedented, example is the federal government's implementation of a hydrogen production tax credit (Section 45V) in the Inflation Reduction Act, which provides a credit of up to $3 per kilogram of hydrogen for qualified clean hydrogen that results in a lifecycle greenhouse gas emissions rate less than or equal to 4 kilograms of $CO_2$ emissions per kilogram of hydrogen.[55] While this is a federal tax provision and does not target critical facilities specifically, it could be considered as a guide for Connecticut. Use of market signals and incentives can make clean hydrogen production more cost-competitive with other fossil fuel sources.

#### 4.1.1.3 | Stakeholder Feedback

During the identification of existing Connecticut decarbonization policy, including hydrogen-related policies, stakeholders helped to determine potential gaps and areas for further action. They also provided feedback regarding identified policies that were deemed not to be relevant to the development of a hydrogen economy or programs that were no longer in existence.

Notably, PURA has provided clarity on the scope of its statutory authority regarding hydrogen. PURA noted that Title 16 does not directly address the production, sale, or distribution of hydrogen gas. However, the language in statutes related to gas companies and natural gas is fairly broad and could be interpreted as extending PURA's jurisdiction to include the distribution of hydrogen by local distribution companies (LDCs) and by other entities. PURA further noted that relevant statutes may require revision to further clarify PURA's role in regulating hydrogen.[56]

51 California Air Resources Board (2020), Funding Programs for Commercial Harbor Crafts.
52 California Energy Commission (2020), Hydrogen Fuel Cell Demonstrations in Rail and Marine Applications at Ports.
53 California Legislature (2022), AB-1312: California Global Warming Solutions Act of 2006: aviation greenhouse gas emissions reduction plan.
54 Washington State Department of Revenue, Tax Incentive Programs.
55 United States Legislature (2022), H.R.5376 – Inflation Reduction Act of 2022.
56 Connecticut Public Utilities Regulatory Authority (2022), Comments to the Hydrogen Task Force, p.2.

Multiple stakeholders, including the Environmental Advocates[57] and the Connecticut Roundtable on Climate and Jobs, expressed concerns regarding the emissions impacts that may result from uncertainty around a definition of hydrogen and identified a policy framework as a potential tool to address these concerns.[58] However, discussion around a definition of clean hydrogen revealed a range of opinions among stakeholders on how to align a state definition with existing regional and federal approaches, which is further discussed in Section 4.2.1. Representatives from the Connecticut DEEP expressed the need for further investigation into what definition would be most valuable for Connecticut before recommending any specific definition and noted that such analysis will be undertaken throughout DEEP's Comprehensive Energy Strategy (CES) process.[59]

The Environmental Advocates also noted there is considerable ambiguity as to which existing regulations are applicable to hydrogen on the state and federal level and specifically noted a lack of regulation for hydrogen end uses.[60] Building on concerns about a lack of regulatory certainty, Eversource noted that a stable regulatory structure that enables the siting and development of clean hydrogen projects will be a key aspect in ensuring that projects can be developed within a reasonable timeline in response to the environmental, safety, and economic concerns voiced by disadvantaged communities.[61]

Eversource recommended that policies be instituted in a way that promotes the development of a clean hydrogen economy rather than attempting to pre-determine any particular end use. Further, Eversource noted that in order to implement hydrogen solutions and facilitate ecosystem development, the state may need to assess the need for modifications or amendments to existing laws and regulations, including those related to the natural gas industry and the role for LDCs. As an example, Eversource cited recent action taken by New York to amend its energy-related legislation to allow LDCs to participate in the alternative fuels sector and suggested that Connecticut may need to consider similar measures.[62]

Other stakeholders recommended specific policies and incentives that should be developed. CCAT recommended that relevant policies and incentives should include commitments to build a broad and complete energy supply chain, develop training and workforce resources, establish and support institutional centers to conduct world class research, provide leadership to demonstrate and deploy technologies for multiple user classes in critical markets, and provide in-kind and monetary cost share for federal grant applications.[63] Bloom Energy recommended the addition of hydrogen generated from carbon free energy sources such as wind, solar, and nuclear to be Renewable Portfolio Standard Class I eligible under Connecticut statute and establishing protocols for hydrogen to be used in the energy sector, particularly in decarbonization of the existing natural gas system and long-term energy storage to aid in further electric grid decarbonization.[64] FuelCell Energy encouraged the consideration of methods to motivate investment within the state through incentives such as tax credits and/or carbon capture credits, both for the price of carbon captured per kilogram and for the price of carbon emissions reduced per ton as well as incentives or grants to expand in state manufacturing.[65]

The importance of community-based recommendations was emphasized by several stakeholders, including the Environmental Advocates, FuelCell Energy, Eversource, CCAT, and Bloom Energy, as discussed further in Section 4.2.3. In written comments, PURA also noted that Public Act 21-43 provides a policy framework for involving

57 The Environmental Advocates include Conservation Law Foundation, Sierra Club, the Nature Conservancy in Connecticut, Acadia Center, Save the Sound, Eastern CT Green Action, and People's Action for Clean Energy.
58 Connecticut Green Bank (2022), Hydrogen Power Study Task Force: Policy Working Group Meeting #2.
59 Connecticut Green Bank (2022), Hydrogen Power Study Task Force: Policy Working Group Meeting #3.
60 Environmental Advocates (2022), Comments to the Hydrogen Task Force, p. 13.
61 Eversource (2022), Comments to the Hydrogen Task Force, p. 2-3.
62 *Id.*, p. 6.
63 Connecticut Center for Advanced Technology (2022), Comments to the Hydrogen Task Force p. 7.
64 Bloom Energy (2022), Comments to the Hydrogen Task Force, p. 4.
65 FuelCell Energy (2022), Comments to the Hydrogen Task Force, p. 6.

disadvantaged communities, as both participants and beneficiaries, through community benefit agreements, and suggested that the Task Force may consider recommendations that build upon Public Act 21-43, which currently applies only to hydrogen in its capacity to power fuel cell generation.[66]

Finally, several stakeholders provided comments regarding the creation of tax exemptions for hydrogen vehicles which is further discussed in Section 4.1.6.3.

## 4.1.2 | Recommendations for workforce initiatives to prepare the state's workforce for hydrogen fueled energy-related jobs.

### 4.1.2.1 | Findings

Hydrogen infrastructure has many similarities to fossil fuel infrastructure, and therefore represents a unique opportunity to repurpose and retrain the existing fossil fuel workforce to enable participation in the state's clean energy transition. Skillsets such as pipefitting, boiler making, and electrical wiring are relevant for hydrogen and existing training programs can be deployed or expanded to facilitate the development of a skilled hydrogen workforce in Connecticut. Through this lens, there is significant opportunity to repurpose, retrain, or upscale workers, while also leveraging the state's expertise in hydrogen technologies, fuel cell manufacturing, and insurance.

Existing training and apprenticeship programs and local labor unions in Connecticut provide a framework through which job training can potentially be expanded and leveraged as necessary to include new skillsets related to the development of hydrogen projects. The Connecticut State Building Trades (CSBT) Council and its affiliates provide 17 joint apprenticeship training programs to prepare workers in building and construction trades,[67] and the Connecticut Department of Labor's Office of Apprenticeship Training facilitates registered apprenticeship programs across a variety of industries.[68] The Northwest Regional Workforce Investment Board additionally offers job training in manufacturing and engineering through the Apprenticeship Connecticut Initiative (ACI) to develop a workforce pipeline in partnership with local community colleges, high schools, employers, and the Manufacturing Service Corporation.[69] These and other programs can be applied and expanded to accommodate future needs and aid in workforce transition.

Executive Order 21-3 established the Connecticut Clean Economy Council (CCEC) to advise on strategies and policies to strengthen the state's climate mitigation, clean energy, resilience, and sustainability programs to lower emissions and advance economic and environmental justice.[70] The CECC shall include leaders across several state agencies, including DECD, DEEP, the Office of Policy and Management, DOT, OWS, and the Office of the Governor, as well as the Connecticut Green Bank and Connecticut Innovations. Among other duties, the council is tasked with efforts to inform the needs for workforce training programs, identify approaches to deploy funding to scale economic opportunities, and support diverse and equitable participation in sectors within the fields of climate and sustainability. The CCEC provides a mechanism for advancing workforce development initiatives related to hydrogen through coordination and partnership from multiple state government and industry stakeholders.

Of note, transportation to and from job sites is not always available to local workers and underscores the importance of community engagement initiatives in workforce development. Community outreach and engagement are beneficial for developing local workforce capability and for understanding community needs and providing avenues to address these needs. Engagement with community leaders and groups provides additional pathways to connect local workers with training and upscaling efforts and presents an opportunity to reach populations that have traditionally been underrepresented in the energy workforce and the broader economy.

66 Connecticut Public Utilities Regulatory Authority (2022), Comments to the Hydrogen Task Force, p.3.
67 Connecticut State Building Trades.
68 Connecticut Department of Labor Office of Apprenticeship Training, Work Schedules - Apprenticeable Trades.
69 Northwest Regional Workforce Investment Board, Manufacturing Your Future with ACI.
70 Connecticut Executive Order No. 21-3 (2021),

Community benefit agreements have been identified by environmental justice and just transition experts as a critical tool for creating local job opportunities. Key provisions can include commitments to use the local workforce, offer prevailing wages, and partner with existing apprenticeship and training programs. Public Act 21-43 includes requirements for community benefit agreements, prevailing wages, and workforce development plans for covered Class I renewable energy projects of 2 MW or greater and can potentially serve as a template for the expansion of policies to facilitate community engagement and local workforce development associated with hydrogen projects.

## ENSURING A JUST TRANSITION – A LABOR PERSPECTIVE

Connecticut Roundtable on Climate and Jobs

**Aziz Dehkan**, Executive Director
*Connecticut Roundtable on Climate and Jobs*

**How has the Roundtable been approaching the topics of equity, workforce development, and environmental justice related to energy?**

The Roundtable led an effort to pass Public Act 21-43 "An Act Concerning a Just Transition to Climate-Protective Energy Production and Community Investment" to emphasize the importance of community investment and engagement. This legislation emerged from an experience with project in East Windsor that did not include a community benefits agreement or prevailing wages, which does not create a level playing field for local labor. We attempted to engage with the developer but did not have success and realized that engaging on a project-by-project basis would not be sustainable. That experience led to Senate Bill 999 (eventually Public Act 21-43), which states that "the developer of a covered project shall (1) take all reasonable actions to ensure that a community benefits agreement is entered into with appropriate community organizations representing residents of the community in which the project is or will be located if the nameplate capacity of the project is five megawatts or more, and (2) take appropriate actions to ensure a workforce development program is established." A "covered project" means a renewable energy project that is situated on land in this state, commences construction on or after July 1, 2021, and has a total nameplate capacity of two megawatts or more. A "covered project" does not include any renewable energy project (A) selected in a competitive solicitation conducted by (i) the Department of Energy and Environmental Protection, or (ii) an electric distribution company, as defined in section 16-1 of the general statutes, and (B) approved by the Public Utilities Regulatory Authority prior to January 1, 2022.

**How would you advise developers of hydrogen and fuel cell projects on the importance of community engagement and local workforce development?**

The community needs to be heard and a clear process with transparency should be undertaken on the part of the developer. It is important to have an open dialogue because most communities want involvement, but this needs to be enforceable on the part of the developer.

#### 4.1.2.2 | Recommendations

Recommendations related to workforce development were informed by Task Force and Working Group activities and conversations with local experts, including representatives from the CSBT Council, who gave a presentation during the October Policy & Workforce Development Working Group meeting in which they shared examples of successful workforce training programs in Connecticut and discussed offerings through the Connecticut State Building Trades Training Institute (BTTI).[71] Representatives from the CSBT also described plans for the BTTI to expand and provide training for careers in renewable energy.

Preparing Connecticut's hydrogen workforce can be advanced through development of a skilled labor pool, ideally converting existing fossil fuel jobs and creating opportunities to reach and involve traditionally underrepresented populations, while leveraging and building upon the state's existing expertise in hydrogen-related technologies and the insurance industry. The following actions should be considered for workforce development in Connecticut:

+ **The OWS should lead coordination – in partnership with UCONN; community colleges; vocational high schools; regional comprehensive universities; Workforce Investment Boards; trades with expertise in hydrogen technologies and relevant skillsets; labor-led workforce development programs and training programs; LDCs, EDCs, and other employers; and any other relevant workforce or training programs – between existing entities such as the Governor's Workforce Council and DEEP to establish a comprehensive program for engagement with local experts to understand workforce development needs and potential specific to hydrogen and hydrogen technologies such as fuel cells and electrolyzers as well as upstream suppliers.** This engagement can occur through appropriate existing venues, such as the Clean Economy Council, established through Executive Order 21-3. Connecticut has extensive experience in hydrogen and related skillsets, and outreach and partnerships with the trades, academia, native hydrogen and fuel cell companies, electric and gas utilities, and local community groups can inform steps to prepare the state's workforce. This effort should:
  - Specifically identify areas of the workforce that are expected to be disproportionately impacted by the state's clean energy transformation and determine existing applicable roles and skillsets, including those that support LDC and EDC operations, to understand the opportunities to repurpose, retrain, or leverage members of the workforce to enable a just transition.
  - Leverage existing frameworks and expand programs to increase training of overlapping job skillsets that can be applied in a hydrogen economy. In addition, this process should explore opportunities to introduce dedicated hydrogen training into initiatives offered through the trades and the Connecticut State Building Trades Training Institute, along with other apprenticeship programs registered with the Department of Labor. Training efforts should include the identification and development of key competencies and the potential for trade certifications for the clean hydrogen industry. Increased emphasis should be placed on establishing or expanding programs to support the workforce in Connecticut's native fuel cell industry, which has a strong footprint within the state and offers a competitive advantage in regional, national, and global markets.
  - Include workforce development in local engagement activities, and as part of a broader effort to develop a community impacts framework that outlines both a vision and goals to be incorporated into hydrogen policy development.
  - Solicit guidance through the CECC, and from CEEJAC and other partners, to establish a working group of state and local government representatives, environmental justice groups, and community representatives to further address hydrogen related topics.

71 Connecticut Green Bank (2022), Hydrogen Power Study Task Force: Policy Working Group Meeting #2.

- For project-specific engagement with communities, groups, institutions, and other partners, outreach efforts should begin as early as possible and guarantee opportunities for involvement are accessible for local stakeholders at times and locations intended to enable participation.
- Continue to pursue workforce diversity to leverage targeted funding available for hydrogen-related training initiatives. For example, DOE's Hydrogen and Fuel Cell Technologies Office is providing $2 million in funding to build a talent pipeline for scientists and engineers from Historically Black Colleges and Universities and Other Minority Institutions to support hydrogen workforce development.[72]

+ **The OWS should partner with relevant state agencies and UCONN; community colleges; vocational high schools; regional comprehensive universities; Workforce Investment Boards; trades with expertise in hydrogen technologies and relevant skillsets; labor-led workforce development programs and training programs; LDCs, EDCs, and other employers; and any other relevant workforce or training programs to further advance the development of a skilled hydrogen workforce and durable supply chain.** Through coordination with Connecticut's existing expertise, a pipeline of workers from universities, community colleges, and vocational schools could be created to support the design, engineering, marketing, coordination, and deployment of hydrogen and related assets in the state. Coordination across these groups, and with industry, is critical and a roadmap should be developed to connect these resources to ensure proactive planning.
+ **UCONN, working in collaboration with community colleges; vocational high schools; regional comprehensive universities; Workforce Investment Boards; trades with expertise in hydrogen technologies and relevant skillsets; labor-led workforce development programs and training programs; LDCs, EDCs, and other employers; and any other relevant workforce or training programs, should identify opportunities to support development of the hydrogen workforce and advance research and development in hydrogen electrolyzers and hydrogen fuel cells, and should identify resources and funding needs to implement and contribute to the development of a hydrogen roadmap led by DEEP.** Such actions would build upon Connecticut's deep expertise and further position the state as a leader in these technologies for regional, national, and global market opportunities.
+ **The Legislature should consider amending requirements for community benefit agreements, through Public Act 21-43, to lower the minimum project size from 2 MW to 1 MW, explicitly note the inclusion of hydrogen, and consider the development of similar requirements for all hydrogen projects.** This would not only support alignment with and maximization of federal investment and production tax credits and associated prevailing wage and apprenticeship requirements but would also provide additional avenues for creating job opportunities locally, by allowing for the expansion of eligible included projects. As part of this process, the Legislature should examine the benefits of including hydrogen specifically or the potential for further actions to develop more comprehensive requirements for community benefit agreements across a broader range of projects involving hydrogen.
+ **The Legislature should provide funding to increase community engagement and decrease the burden of engagement on communities.** This may include compensation for community participation in hydrogen-related proceedings and funding for time, resources, and technical expertise for the development of community benefit agreements that provide opportunities for local jobs. Additional funding should be considered for overcoming transportation challenges in enabling community members to access and work at local job sites for projects involving or relevant for the state's hydrogen economy.
+ **Eligible entities should pursue federal funding for manufacturing capabilities for electrolyzers and hydrogen fuel cells, to further advance development in the state.** These efforts would support Connecticut's strong native fuel cell industry and related workforce and offer an opportunity to build a competitive advantage for the state in regional, national, and global markets for hydrogen development.

72 U.S. Department of Energy National Energy Technology Laboratory (2022), NETL Announces Additional $2 Million to Prepare Tomorrow's Clean Energy Innovators.

Entities should communicate with the Legislature regarding obstacles and barriers related to federal funding, and the Legislature should consider matching of federal dollars, as outlined in Section 4.1.3.2, and may consider exploring additional incentives to promote the expansion of manufacturing in Connecticut, benchmarked against actions taken in other states. Further coordination with existing training and apprenticeship programs will be critical to developing a hydrogen workforce.

+ **With regard to hydrogen infrastructure insurance, steps should be taken to ensure clear rules and policies for hydrogen infrastructure to support insurance industry workforce opportunities.** Such actions would support insurance industry workforce opportunities and to enable standardized hydrogen insurance products that can be marketed nationally. Hydrogen is still relatively new for the insurance industry, and efforts to support innovative and detailed approaches to risk assessment and underwriting would boost Connecticut's position as a leader in the insurance industry.

#### 4.1.2.3 | Stakeholder Feedback

Industry stakeholders such as Nel Hydrogen and FuelCell Energy have identified workforce development as a key area where the state can play an important role. FuelCell Energy noted the tight labor market, and that skilled workers will be needed in the manufacturing facilities that make hydrogen production equipment, and in hydrogen production and distribution facilities and infrastructure.[73] Representatives from the Connecticut State Building and Construction Trades Council emphasized the importance of including fossil fuel workers in the clean energy transition. They suggested that some skillsets required for fossil fuel jobs, such as pipefitters and boilermakers, could be directly transferrable to hydrogen-related roles.[74]

PURA emphasized that the state should focus funding on building foundational workforce resources that will support the projects being funded with federal dollars. In particular, the state should work to address training and certification gaps that are either not provided, or not available at the scale needed by private industry.[75]

Another common theme in stakeholder feedback has been the desire for a stronger equity component in workforce development recommendations. The Environmental Advocates stated that Connecticut should focus on creating targeted clean hydrogen workforce development opportunities for populations that face systemic discrimination or are underrepresented in the workforce, including women, minorities, people with English as a second language or limited English proficiency, and formerly incarcerated individuals. They also emphasized that hydrogen-related career pathways should also be made available to people who currently work in the fossil fuel industry.[76]

The Environmental Advocates also recommended that training and apprenticeship programs could be established at community colleges and technical high schools or training institutes. They noted that it may be most efficient for hydrogen workforce development initiatives to be integrated into broader clean energy training programs, rather than setting them up as standalone programs. This would limit the risk of new trainees having trouble finding employment in a particular field or sector, for example, if the deployment of a particular technology or approach does not occur as quickly as expected.[77]

Other key topics mentioned by stakeholders regarding workforce development included project labor agreements, prevailing wages, and ensuring a just transition. Representatives of the Greater Bridgeport Community Enterprises and the Connecticut Roundtable on Climate and Jobs advocated the importance of environmental justice and community engagement in economic development work, noting that a supportive community atmosphere can encourage local job growth.[78]

73 FuelCell Energy (2022), Comments to the Hydrogen Task Force, p. 6.
74 Connecticut Green Bank (2022), Hydrogen Power Study Task Force: Policy Working Group Meeting #2.
75 Connecticut Public Utilities Regulatory Authority (2022), Comments to the Hydrogen Task Force, p. 6.
76 Environmental Advocates (2022), Comments to the Hydrogen Task Force, p. 6.
77 *Ibid.*
78 Connecticut Green Bank (2022), Hydrogen Power Study Task Force: Policy Working Group Meeting #2.

### 4.1.3 | An examination of how to position the state to take advantage of competitive incentives and programs created by the federal Infrastructure Investment and Jobs Act.

#### 4.1.3.1 | Findings

The IIJA was passed in November 2021 with bipartisan support. The law contains $1.2 trillion to support a wide variety of investments including power grid modernization, low- and zero-emissions vehicle infrastructure, climate resiliency, port modernization, and water infrastructure.

The IIJA has substantial opportunities that can be applied to projects across the hydrogen value chain. The IIJA contains several hydrogen-specific provisions and funding opportunities. For example, the law includes $8 billion towards the development of regional clean hydrogen hubs,[79] $1 billion towards electrolysis research, development, and demonstration, and $500 million towards clean hydrogen technology manufacturing and recycling RD&D.[80] Further, this law includes additional provisions that can be applied towards deployment of equipment and infrastructure for the end-use of hydrogen. For example, it contains $2.5 billion for Charging and Fueling Infrastructure Grants that may support development of hydrogen fueling stations for mobility applications, $2.25 billion in Port Infrastructure Development Program Grants, and funding directed towards additional end uses.[81]

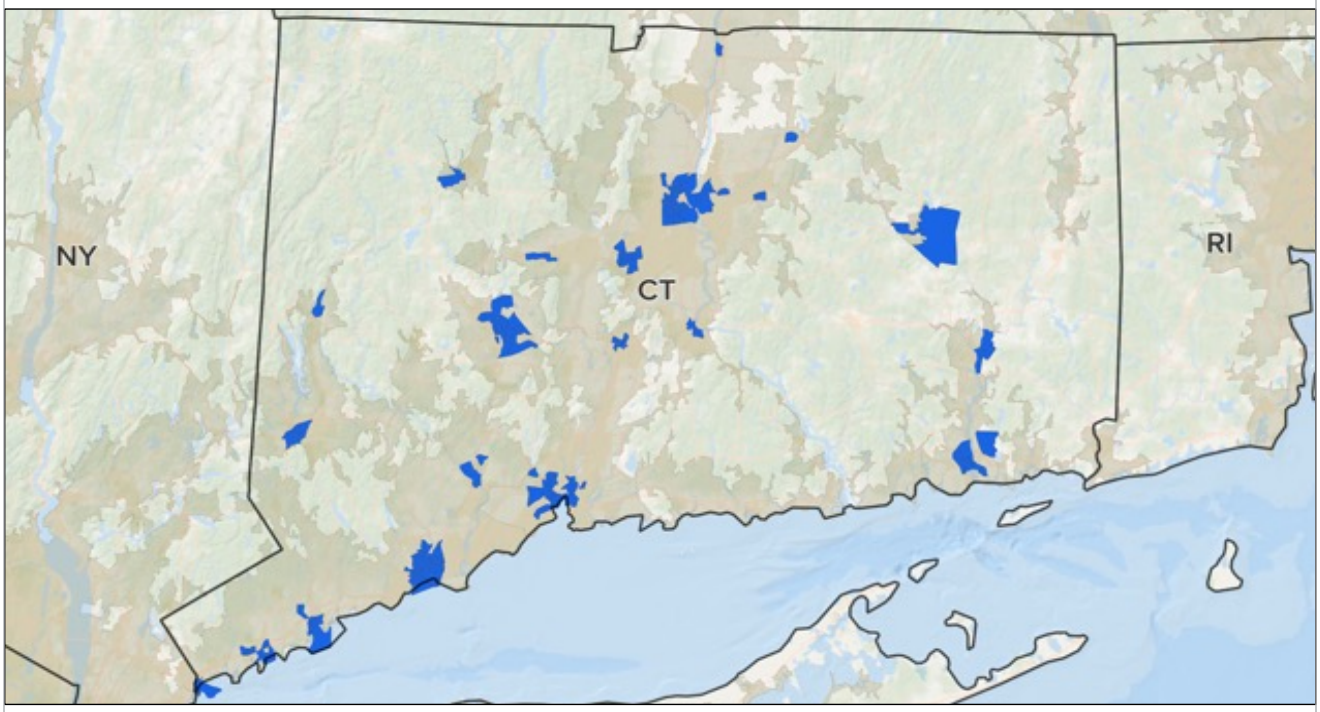
In an examination of how to position the state to take advantage of competitive incentives and programs in the IIJA, the Funding Working Group identified the following key areas of focus: (1) the importance of prioritizing community engagement and ensuring benefits to Disadvantaged Communities in adherence to the Justice40 Executive Order and (2) the need to identify and maximize sources of non-federal funding to meet grant match requirements.

**Justice40 Coverage in the IIJA: Community Engagement and Disadvantaged Communities**

Many programs within the IIJA are covered by the Biden Administration's Justice40 Executive Order (EO 14008), which directs 40% of the overall benefits of certain federal incentives to flow towards disadvantaged communities (DACs). To be considered as a DAC, a census tract must rank in the 80th percentile of the cumulative sum of 36 burden indicators and have at least 30% of households classified as low income. Federally recognized tribal lands and U.S. territories are also categorized as disadvantaged. The White House has published a list of all programs covered under Justice40.[84]

79 United States Department of Energy Office of Clean Energy Demonstrations, Regional Clean Hydrogen Hubs.
80 Pillsbury Winthrop Shaw Pittman LLP (2021), Hydrogen Highlights in the Bipartisan Infrastructure Bill.
81 For a thorough overview of opportunities that may be applied to hydrogen in the IIJA, please refer to Appendix D.
82 Executive Office of the President, Office of Management and Budget (2021), Interim Implementation Guidance for the Justice40 Initiative.
83 White House, Justice40.
84 White House (2022), Justice40 Initiative Covered Programs List.

## FIGURE 5. DISADVANTAGED COMMUNITIES IN CONNECTICUT PER U.S. DEPARTMENT OF ENERGY'S DEFINITION




**Source:** White House Justice40 Initiative

Justice40 is being implemented in federal programs to ensure DACs receive the benefits of federal investments under the covered categories. For example, the Funding Opportunity Announcement for H2Hubs includes a Community Benefits Plan accounting for 20% of the proposal scoring criteria, in which applicants must demonstrate how they will:

+ Carry out meaningful community and labor engagement;
+ Invest in the American workforce;
+ Advance diversity, equity, inclusion, and accessibility; and
+ Contribute to the Justice40 Initiative goal that 40% of the overall climate and clean energy investments flow to disadvantaged communities.[85]

These Community Benefits plans will be evaluated based upon a variety of factors, including their ability to measure and track impacts, the ability to specifically demonstrate how the H2Hub will provide societal benefit while minimizing negative impacts, support from Workforce and Community Agreements, the presence of communities as core partners, and more.

85 Latham and Watkins (2022), DOE Releases Draft Clean Hydrogen Production Standard, Draft Roadmap, and Hydrogen Hub Funding Opportunity.

## ENVIRONMENTAL JUSTICE AND COMMUNITY ENGAGEMENT — A COMMUNITY PERSPECTIVE

**Adrienne Farrar Houël,**
President and CEO
*Greater Bridgeport Community Enterprises*

**Can you tell us about Bridgeport and its participation in the Department of Energy's Communities LEAP program?**

As an old industrial city, Bridgeport has a long history of industrial abuse of our local environment. The Connecticut Department of Energy and Environmental Protection identifies Bridgeport as an Environmental Justice community, and our Department of Economic Development has designated Bridgeport a Distressed Community. About 20% of households in Bridgeport are below the poverty level, leading to a significant energy burden at 6.2%. Over a year ago, the Bridgeport Regional Energy Partnership (BREP) was created to facilitate state and federal funding and investment in clean and renewable energy in our community. Working with Operation Fuel, Connecticut Green Bank, the City of Bridgeport, and the Bridgeport Regional Business Council, we recruited over 40 community organizations to form BREP. With founding organizations, we sought DOE technical assistance for community-driven, city-wide energy planning, and Bridgeport was selected as one of 24 cities across the country for the Communities Local Energy Action Plan (LEAP) pilot program. Three pathways were selected to pursue clean and renewable energy projects and programs:

1 *Energy Efficiencies to Reduce Energy Burdens (in the built environment)*
2 *Clean Energy Planning and Development including Resiliency and Transportation*
3 *Advanced Manufacturing, Energy-Focused Workforce and Supply Chain Development*

**How should the Task Force and the Northeast Regional Clean Hydrogen Hub be thinking about environmental justice and community engagement?**

Communities in Connecticut understand the extent of their energy burdens but need support in developing comprehensive plans to address them. As a first step, criteria to identify the components of positive community impact must be determined. Therefore significant, planned community outreach is needed, which requires expansive skillsets and relevant messaging support. Funding will be needed for recruitment to engage and support skilled personnel in this area. It is important for the community to acquire a certain level of technical understanding so that they can generate a comprehensive plan that accurately expresses community needs and identifies the best solutions that meet defined criteria. Best practices from neighboring states may be leveraged since many are navigating similar issues, including initiating community environmental benefits.

GREATER BRIDGEPORT COMMUNITY ENTERPRISES, INC.
THE GREEN TEAM

Connecticut is well-positioned to be a first mover in bringing the vision of Justice40 to reality, with its strong existing commitments to a just energy transition. These existing relationships can provide a channel for strong collaboration with communities around IIJA activities. Examples of Connecticut's leadership in community engagement include:

+ **S.B. 999 (Public Act 21-43): Ensuring Community Benefit Agreements for Energy Projects:** This landmark state legislation is the first of its kind, codifying the industry best practice for community engagement. It ensures that host communities for Class I renewable energy projects (including fuel cells) ≥2MW receive real benefits by requiring developers to negotiate community benefits agreements.[86]
+ **Executive Order No. 21-3:** DEEP Environmental Justice Advisory Council: Connecticut established an avenue for meaningful and direct feedback on issues such as permitting, equitable program delivery, and more. "The purpose and mission of the CEEJAC is to advise the Commissioner of DEEP on current and historic environmental injustice, pollution reduction, energy equity, climate change mitigation and resiliency, health disparities, and racial inequity."[87]
+ **Bridgeport Selected to Participate in the Communities LEAP Program:** Bridgeport, CT was one of 24 selected communities that will work with U.S. DOE, national labs and other experts, community-based organizations, utilities, environmental organizations, economic development organizations, equity organizations and others to develop roadmaps for clean energy economic development pathways.[88]

### Match Funding Requirements in the IIJA and Sources of Non-Federal Matching

Many IIJA funding opportunities require applicants to commit varying levels of non-federal match funding. For example, the H2Hubs application requires a 50% non-federal cost share requirement, while many of the clean transportation grants and programs only require 10 – 20%.

Sources that are eligible for match funding include:[89]

+ Third-party financing;
+ State or local government funding or property donations;
+ Project participant funding; and
+ Donation of space or equipment.

Sources that cannot be used for cost sharing include:[90]

+ Any partial donation of goods or services;
+ Revenues or royalties from the prospective operation of an activity beyond the project period;
+ Proceeds from the prospective sale of an asset of an activity;
+ Federal funding or property (e.g., federal grants, equipment owned by the federal government); or
+ Expenditures that were reimbursed under a separate federal program.

86 Connecticut General Assembly (2021), Public Act 21-43.
87 Connecticut DEEP, Connecticut Equity and Environmental Justice Advisory Council.
88 United States Department of Energy, LEAP Communities.
89 Department of Transportation (2022), Understanding Non-Federal Match Requirements.
90 United States Legislature (2021), Infrastructure Investment and Jobs Act.

Thus, based on match funding guidance, state sources could include: [91]

+ Funding from existing hydrogen-related programs;
+ Funding from newly established hydrogen-related programs;
+ Funding from participating developers;
+ Legislative appropriations;
+ Local government funding;
+ Donations of property from the government; and
+ Donations of property, or equipment from participating partners.

Connecticut has several eligible programs which may be explored for potential eligibility to serve as non-federal matching funds needed for many grants in the IIJA. Existing programs for consideration include, but are not limited to the following examples in Table 2:

## TABLE 2. CONNECTICUT PROGRAMS POTENTIALLY ELIGIBLE FOR IIJA MATCH FUNDING

| Program | Administrator | Description |
|---|---|---|
| Smart-E Loans | CT Green Bank | Provides low-interest financing with flexible terms for home energy performance upgrades. |
| C-PACE | CT Green Bank | Provides building owners access to affordable, long-term financing for qualifying clean energy and energy efficiency options. |
| Capital Solutions | CT Green Bank | Seeks to provide access by project developers and capital providers or investors to Green Bank capital. |
| Brownfield Remediation Grants and Loans | DECD | Provides loan financing or grants to eligible entities for costs associated with the investigation, assessment, remediation, and development of a brownfield. |
| The Manufacturing Innovation Fund Apprenticeship Program | DECD | Supports a combination of on-the-job training and classroom instruction for apprentices in Connecticut's manufacturing industry. |
| The Innovative Energy Solutions Program | PURA | Provides funding projects for developers and utilities to test and demonstrate technologies across the electric grid. |
| Residential Renewable Energy Solutions | Electric Distribution Companies | Provides 20-year tariffs for residential projects (including affordable housing, providing tariff and Renewable Energy Certificate payments. |
| Non-Residential Renewable Energy Solutions Program | Electric Distribution Companies | Provides 20-year tariffs for commercial energy projects, providing tariff and Renewable Energy Certificate payments. |
| Shared Clean Energy Facility Program | Electric Distribution Companies | Provides a 20-year tariff term for projects between 100kW and 4,000 kW. Credits are applied to bills of participating electric customers at no cost. |
| Microgrid Grants and Loans | DEEP | Helps to support local distributed energy generation for critical facilities. |

It is important to note that further legal analysis would be needed to understand the eligibility of these sources and different funding mechanisms to serve as match funding. For example, additional clarity is needed from relevant agencies to understand if state tax incentives and tariffs may qualify as match funding within the IIJA. As of this time, federal agencies are still working on this guidance.

91 Colorado Department of Local Affairs, Local Match Program.

#### 4.1.3.2 | Recommendations

To position the state to take advantage of competitive incentives and programs in the IIJA, Connecticut should consider the following actions:

+ **DEEP should lead interstate and interagency coordination to develop a hydrogen roadmap and strategy that identifies hydrogen supply and demand scenarios; approaches to a clean hydrogen backbone to enable cost-effective scaled transport; and other research and infrastructure investment opportunities to inform policy development and funding and R&D strategy, in consultation with ecosystem stakeholders.** DEEP is supporting the Northeast's multi-state collaboration to develop a proposal to become one of the regional clean hydrogen hubs, coordinating with Connecticut entities across the hydrogen value chain. Their central role will allow them to coordinate parallel policy development and funding efforts, ensuring alignment with the regional vision.
+ **The Legislature should create a transparent source for municipalities, cities, and other local applicants to access resources, such as match funding and/or application guidance.** This is being undertaken in other states to streamline the process of identifying match funding and project partners. For example, Colorado has established a Local Match Program, which allocates $80 million in state General Funds for the non-federal match requirements in the IIJA and a central webpage to inquire about funds.[89] California has a Grants Ombudsman that serves as an independent and confidential resource to help navigate the California Energy Commission grant programs.[92] A similar model could be adapted to serve as a resource for Connecticut entities on federal opportunities. Separately, California passed a state law, SB 1075, which established a California Clean Hydrogen Hub Fund within the State Treasury that could, upon appropriation, authorize match funding.[93]
+ **The Legislature should consider appropriating grant funding to support federal match requirements.** This may apply to the entire value chain, including manufacturing, production facilities, and multi-sector enabling infrastructure, such as public access fueling stations for trucks, commuter buses, ports, and material handling equipment. End-uses may be prioritized based on:
  - High societal benefit and strong underlying economics for hydrogen (more information on end use prioritization can be found in the 4.1.7.2);
  - Significant federal grant opportunities with low requirements of match funding (more information can be found in Appendix D.);
  - Ability to be deployed near-term (e.g., high technology-readiness. More information on this assessment can be found in Appendix A.).
+ **The Legislature should provide funding to increase community engagement and decrease the burden of engagement on communities.** Community benefit agreements and Justice40 requirements are important steps in creating a more inclusive and equitable energy transition, but they will require considerable time and resources from local stakeholders to engage effectively. The state can further demonstrate its support for communities by providing funding for time and resources (e.g., technical expertise and consulting services) to develop community benefits agreements.
+ **DEEP and PURA should consider implementing an intervenor compensation program to increase community participation in hydrogen-related proceedings.** As an example, Minnesota, California, Idaho, Oregon, and Wisconsin all have implemented similar programs.[94]

92 California Energy Commission, Grants Ombudsman.
93 California Legislature (2022), Senate Bill 1075.
94 National Association of Regulatory Utility Commissioners (2021), State Approaches to Intervenor Compensation.

#### 4.1.3.3 | Stakeholder Feedback

CCAT noted that continued interagency coordination and clear policy commitments will be key to obtain competitive federal funding and demonstrate Connecticut's commitment to hydrogen deployments.[95] Also noting the importance of cost sharing, stakeholders have shared ideas that include the potential of a future bond issuance from the legislature, which could provide matching grant funds to a project if awarded, paid for through taxpayers.[96]

Stakeholders have also brought up the need for further community engagement, education, and outreach to ensure that equitable benefits are realized from a Connecticut hydrogen economy.

The Environmental Advocates have emphasized that to increase transparency and public awareness of federal funding opportunities, the state should create a publicly accessible, searchable database with information on federal funding opportunities and the status of projects that have applied for or received funding. They highlighted that by providing information about hydrogen funding opportunities and transparency around projects, stakeholders and the public can better engage in the development of clean hydrogen projects in Connecticut.[97] In discussing match funding opportunities in the Working Group, Sierra Club emphasized that key feedstocks should be prioritized and highlighted that further investigation is still required to learn more about environmentally appropriate uses of hydrogen.[98] Similarly, they noted that recommendations could be more specific about how the legislature can focus their efforts for match funding.

Conservation Law Foundation also noted that environmental justice advocates and allies have been concerned that Justice40 does not include race as a criterion to assess disadvantaged communities. They shared that race is one of the best predictors of which communities face disproportionate environmental burdens.[99] The Conservation Law Foundation also inquired about the potential of a public-facing resource that shows the availability of federal funding and status of dispersed funding. DEEP noted that there may be interest in a resource like this, such as a web page, that compiles all the relevant information including the initiatives of the ongoing work that organizations are doing and the related hydrogen funding opportunities.

Notably, the Regional Clean Hydrogen Hub initiative of the IIJA is unique in requiring a regional submission with many different participants. However, lessons can be learned from Connecticut stakeholders since they have experience applying to federal funding opportunities, which may be leveraged to inform applications to competitive opportunities in the IIJA. Many Connecticut stakeholders across the value chain have been active in the regional Clean Hydrogen Hub initiative by the U.S. Department of Energy (DOE), for which the first stage of applications are due in April. FuelCell Energy also noted that they also routinely apply for and receive federal funding to advance the development of their hydrogen production platforms.[100] They explained that the typical mechanism is a cost shared grant, awarded on a competitive basis. LuftCar also noted that they have been applying to DOD and DOT grants in addition to DOE grants.[101]

95 Connecticut Center for Advanced Technology (2022), Comments to the Hydrogen Task Force, p.7.
96 Connecticut Green Bank (2022), Hydrogen Power Study Task Force: Funding Working Group Meeting #3.
97 Environmental Advocates (2022), Comments to the Hydrogen Task Force, p. 14.
98 Connecticut Green Bank (2022), Hydrogen Power Study Task Force: Funding Working Group Meeting #2.
99 Connecticut Green Bank (2022), Hydrogen Power Study Task Force: Funding Working Group Meeting #1.
100 FuelCell Energy (2022), Comments to the Hydrogen Task Force, p. 6.
101 LuftCar (2022), Comments to the Hydrogen Task Force, p. 2.

### 4.1.4 | An examination of the sources of potential clean hydrogen, including, but not limited to, wind, solar, biogas and nuclear.

#### 4.1.4.1 | Findings

Strategen examined the production potential of clean hydrogen from five carbon-neutral resources – solar, onshore wind, offshore wind, biogas,[102] and nuclear – that may be utilized to power water splitting technologies such as electrolysis. This analysis aimed (1) to set a ceiling for hydrogen production in Connecticut based on limitations imposed by land quantity, natural resource quality, system efficiency, and price forecasts and (2) to approximate production price points for hydrogen sourced from different types of clean energy, considering federal incentives from the IRA.

## CONNECTICUT'S NUCLEAR RESOURCES — AN OVERVIEW OF DOMINION'S MILLSTONE POWER STATION

**LOCATION:** Waterford, Connecticut

**EMPLOYEES:** 1,000

**TYPE:** Generator

**TECHNOLOGY:** Nuclear Power Plant – Pressurized Water Reactors

**PRODUCTION:** 16,000-17,000 GWh of zero emission electricity annually with 9,000 GWh procured as a zero-carbon resource for Connecticut locking in low-cost (i.e., 4.999 cents) and long-term (i.e., 10 years) carbon-free energy

**INSTALLATION:** 2,100 MW (863 MW from Unit 2 License through 2035; and 1,233 MW from Unit 3 License through 2045)

**FUN FACT:** Dominion Energy was an original investor in the second largest fuel cell project in the world in Bridgeport, Connecticut.

102 Sierra Club and the Conservation Law Foundation have noted that the carbon intensity of biogas may differ depending on the feedstock and some feedstocks may not produce carbon neutral biogas.

The siting potential of solar and onshore wind was defined using National Renewable Energy Laboratory (NREL) supply curves.[103] Offshore wind capacity potentials were also sourced from NREL,[104] and estimates for biogas supply were based on analysis by the American Gas Foundation (AGF).[105] In addition, Strategen assessed the potential to utilize curtailed electricity to produce hydrogen using levels of expected curtailment from the ISO-NE Pathways Study.[106]

Strategen developed three production scenarios for hydrogen that represented different levels of limiting assumptions for clean energy production, summarized in the table below. After assessing the total technical production potential in each scenario, Strategen subtracted the capacity that would be required to meet Connecticut's target of achieving 100% zero-carbon electricity established in Connecticut Public Act 22-5 (as outlined in DEEP's 2021 Decarbonization Integrated Resource Plan)[107] to arrive at an estimate of the total clean energy capacity that would be available for hydrogen production. More details of this analysis, including underlying inputs and assumptions, are provided in Appendix C.

## TABLE 3. HYDROGEN PRODUCTION CASES

| Production Case | Low Case | Mid Cass | High Case |
|---|---|---|---|
| Siting restrictions for solar and onshore wind | NREL "Limited Access" Scenario | NREL "Reference Access" Scenario | NREL "Reference Access" Scenario |
| Offshore wind technologies allowed | Fixed-bottom only | Fixed-bottom only | Fixed-bottom and floating |
| Nuclear supply potential[108] | 2.5% of Millstone's average capacity | 5% of Millstone's average capacity | 10% of Millstone's average capacity |
| Biogas supply potential | AGF "Low" Scenario | AGF "High" Scenario | AGF "High" Scenario |
| Curtailment forecast | In line with ISO-NE Pathways Study (Status Quo Scenario) | | |

For land-based resources, the production potential for solar energy in Connecticut was determined to be the highest, significantly larger than the production potential from onshore wind. While having a much overall smaller capacity factor (16.7%) compared to onshore wind (40%), the total technical generation capacity for solar under the Low Case totaled around 30,000 MW, and around 119,000 MW under the Mid and High Cases. By contrast, the total capacity potential for onshore wind for the Low Case is around 112 MW, and 1,800 MW for the Mid/High Case. By comparison, in order to meet the state's zero-carbon electricity target, Connecticut is expected to add 2,300 MW of solar capacity and 400 MW of onshore wind capacity by 2040.

103 NREL defines its supply scenarios as follows:
"NREL developed geospatial data showing solar and wind supply curves, which characterize the quantity and quality of such resources. The data is provided for three land access levels:
a) The **Open Access** supply curve data only applies land area exclusions based on physical constraints (e.g., wetlands, building footprints) or for protected lands.
b) The **Reference Access** supply curve data applies a wider range of exclusions and is used by default in NREL's capacity expansion modeling.
c) The **Limited Access** supply curve data applies the most restrictive land area exclusions, capturing potential increased setback requirements and difficulties deploying on federally managed lands."
More details available at https://www.nrel.gov/gis/solar-supply-curves.html

104 Lopez, Anthony et al., National Renewable Energy Laboratory (2022), Offshore Wind Energy Technical Potential for the Contiguous United States.

105 American Gas Foundation (2019), Renewable Sources of Natural Gas: Supply and Emissions Reduction Assessment.

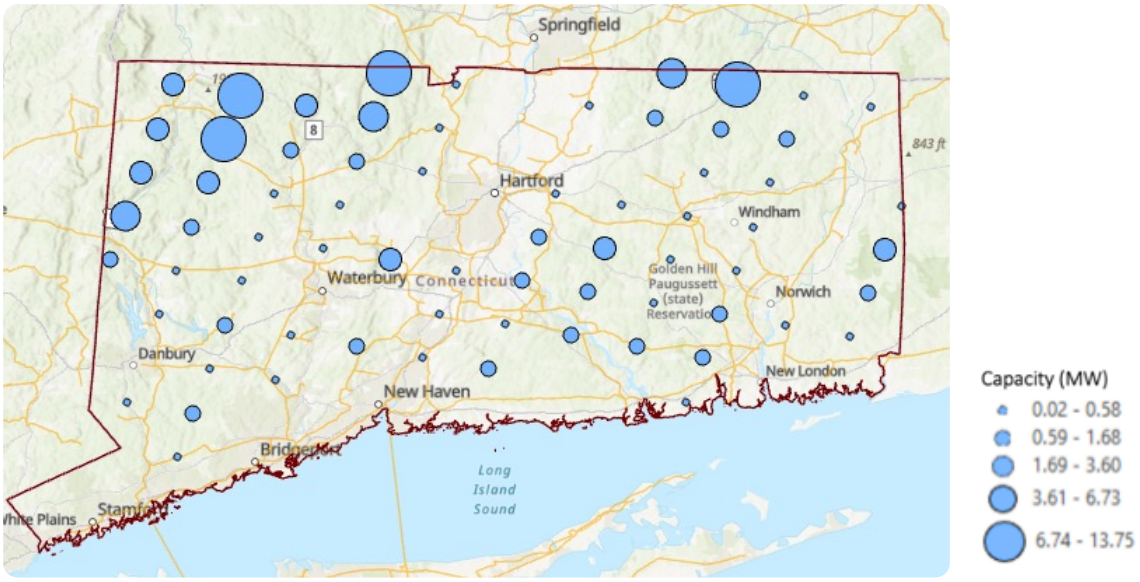
106 Schatzki, Todd, et al., ISO New England (2022), Pathways Study: Evaluation of a Pathways to a Future Grid.

107 Based on the DEEP Decarbonization Pathway IRP, Millstone Extension Scenario (as used in ISO-NE Pathways Study).

108 Interviews with Dominion confirmed that some amount of Millstone's existing capacity could be allocated to hydrogen production in the future, but the exact amount would be dependent on future economic conditions that the company could not speak to at this time. Instead, it was recommended that this analysis present a range of possible scenarios for hydrogen production from nuclear power in the state. "Average capacity" here refers to Millstone's average capacity factor over the last 10 years (roughly 90.6%).

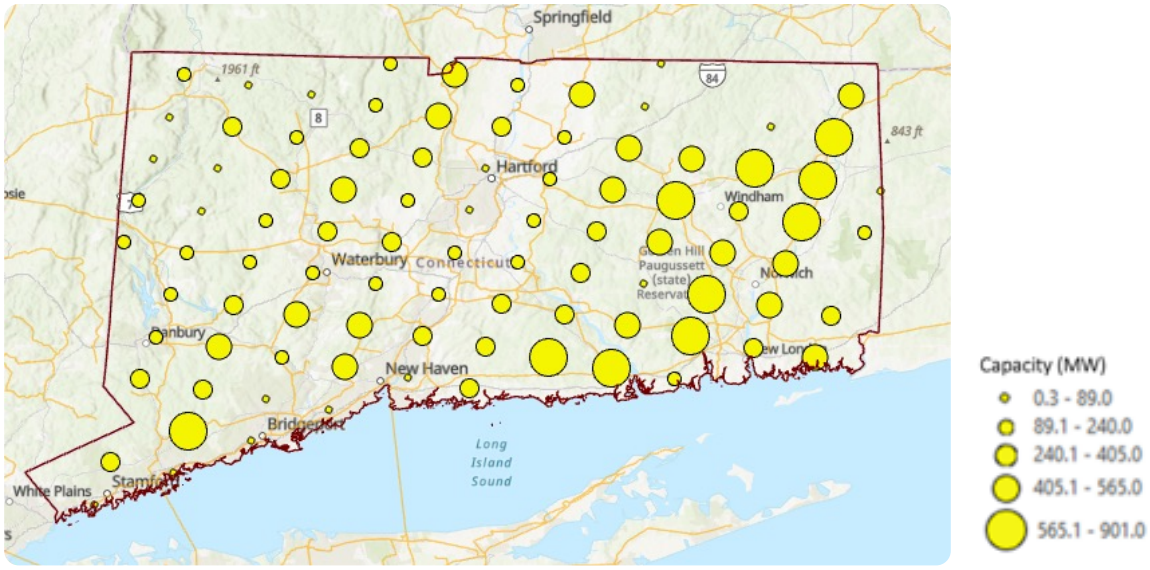
The production potential for these two resources is not evenly distributed across the state. For solar energy, the overall level of generation is highest on the east side of Connecticut, ranging from 1,443 MW to 2,544 MW in the Mid Case. The potential is the lowest in some parts of central-North and the Southwest coastal area of Connecticut, with a potential ranging from 26 MW to 466 MW. By contrast, most of potential wind capacity is in the northwest of the state, with an estimated potential around 60 MW under the Mid/High Case. The figures below provide a geographical representation of wind and solar production potential in Connecticut under the Low Production Case. Please note that the scales for each map are different, with more details provided by the key to the right of each map.

## FIGURE 6. ONSHORE WIND TECHNICAL POTENTIAL IN LIMITED ACCESS SCENARIO




**Source:** Strategen Consulting

## FIGURE 7. SOLAR TECHNICAL POTENTIAL IN LIMITED ACCESS SCENARIO




**Source:** Strategen Consulting

Under the Low Case scenario, after accounting for Connecticut's general decarbonization needs as stated in the DEEP Decarbonization Pathway IRP,[109] Strategen found that available clean energy capacity could produce 2.3 million metric tons (Mt) of hydrogen within the state's territory annually, roughly 6 times higher than what would be required to cover the energy consumption of all medium-and heavy-duty trucks (Class 3-8) in Connecticut in 2020.[110] This could be increased to 4.9 Mt per year in the Mid Case and 8.1 per year Mt in the High Case, if less restrictive siting limitations and other technology improvements were assumed.

Solar and offshore wind provide the largest bulk hydrogen production opportunities for Connecticut, with biogas, nuclear, and curtailed energy providing relatively small levels of production. Onshore wind energy only contributed to hydrogen production in the Mid and High Cases, as in the Low Case, 100% of available onshore wind capacity was required to meet Connecticut's decarbonization targets. This technical potential only considered resources located within Connecticut or, in the case of offshore wind,[111] resources located off the North Atlantic coast and allocated to Connecticut in proportion to its share of regional energy demand in 2021.[112] As such, these values represent the clean energy potential specific to Connecticut and not necessarily the most economic resources to be developed in the wider power system region.

Following the energy capacity assessment, Strategen used technology price forecasts from NREL,[113] local resource characteristics, and currently available information on tax credits in the Inflation Reduction Act (IRA) to calculate the levelized cost of energy (LCOE) for each clean energy source. These LCOE values were then modeled, along with IRA benefits and expected improvements on electrolyzer technology, to forecast the levelized cost of hydrogen (LCOH) from dedicated clean energy generators in the state. The resulting values represent the production cost of the fuel and do not include any transportation, compression, or storage costs.

Both the quantity and price of hydrogen that could be produced from each source of clean energy under the Mid Case in 2030 and 2040 are summarized in the following graphs. The Mid Case was selected as its parameters are meant to outline a "base case" for hydrogen production in Connecticut. Estimates for the Low and High Cases, as well as the inputs and assumptions that were used to calculate the LCOH values in each graph are provided in Appendix C. Because the technical potential for renewable energy production in Connecticut is static over time, the estimates for the volume of hydrogen that could be produced in 2030 and 2040 are roughly the same. The only difference is in estimates for hydrogen production from excess renewable energy, which are higher in 2040 due to higher forecasted curtailment levels in that year. Because estimates for renewable energy curtailment in 2050 aren't available at this time, a supply curve for 2050 wasn't constructed.

109 Based on the DEEP Decarbonization Pathway IRP (as used in ISO-NE Pathways Study).

110 Seamonds, David et al., M. J. Bradley & Associates (2021), Southern New England: An Analysis of the Impacts of Zero-Emission Medium- and Heavy-Duty Trucks on the Environment, Public Health, Industry, and the Economy.

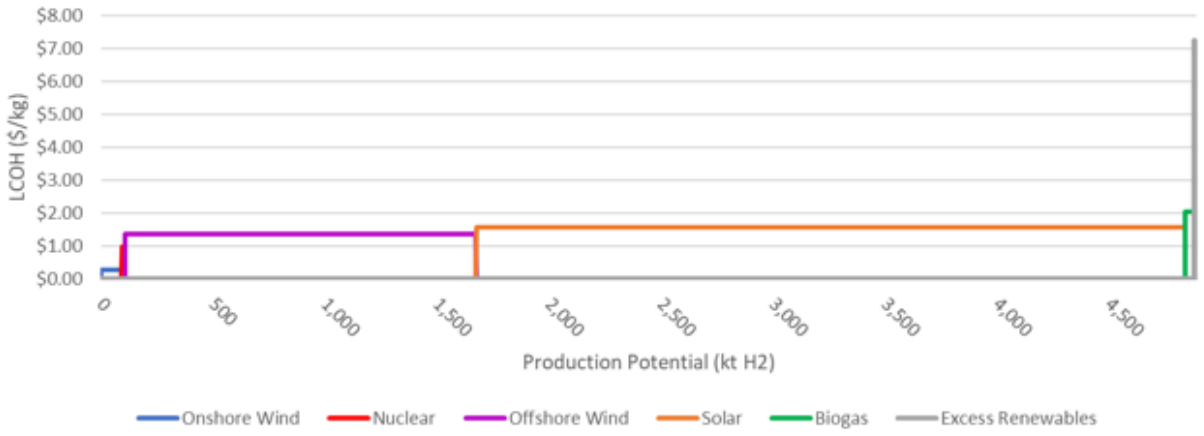
111 Notably, Connecticut must procure offshore wind that interconnects within Connecticut to be comparable to the solar and onshore analysis; therefore, power supply should be viewed with a regional perspective. Further, onshore wind developments may require virtual connections via PPAs.

112 In this case, "regional" refers to all U.S. states with access to the North Atlantic coastline, specifically: Connecticut, Massachusetts, Maine, New Hampshire, New Jersey, Rhode Island, and New York.

113 NREL's Annual Technology Baseline 2022 provides consistent, freely available, technology-specific cost and performance parameters across a range of R&D advancements scenarios, resource characteristics, sites, and financial assumptions for electricity-generating and storage technologies, both at present and with projections through 2050. These values were adjusted for Connecticut using regional Capex parameter variations and adjustments of each technology.

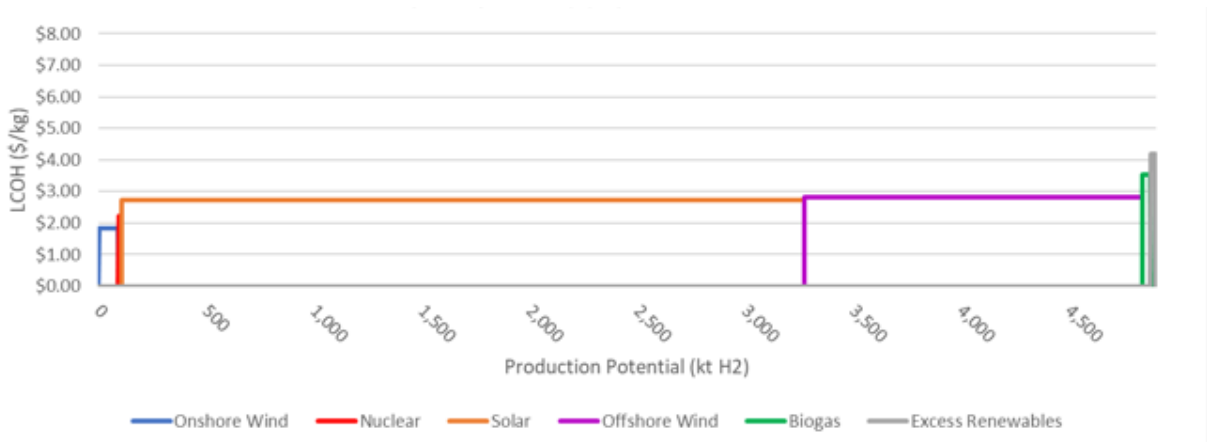
From a price perspective, the costs of hydrogen are generally higher in 2040 due to the expected phase-out of tax credits for clean energy and clean hydrogen production in 2032.[114] For reference, in order to reach price parity for diesel, hydrogen would need to fall under $5.13/kg delivered cost in 2030, inclusive of the costs associated with transportation, storage, and distribution (which aren't included in the LCOH estimates below). More information on hydrogen price parity points and infrastructure costs are provided in Section 4.1.7.

## FIGURE 8. 2030 HYDROGEN SUPPLY CURVE FOR MID PRODUCTION CASE




**Source:** Strategen Consulting

## FIGURE 9. 2040 HYDROGEN SUPPLY CURVE FOR MID PRODUCTION CASE




**Source:** Strategen Consulting

The above analysis focused on wind, solar, nuclear, and biogas resources in Connecticut, as these were the potential resources considered that may be utilized to power water splitting technologies such as electrolysis to produce hydrogen as explicitly mentioned in the Task Force legislation. However, as Connecticut refines its hydrogen strategy in the future, there are a number of other potential production methods for hydrogen that could yield additional cost advantage, such as hybrid renewable installations, hydrogen imports, or direct grid connections.

114 Analysis assumes that hydrogen project developers are able to monetize the full value of the tax credit on tax equity markets.

**Hybrid Renewable Installations:** Tying hydrogen production to multiple renewable energy sources can improve electrolyzer capacity factors and further reduce hydrogen costs. For example, co-locating an electrolyzer with a solar plant while also tying production to an offshore wind installation (either through a direct interconnection or a PPA -type structure) would allow the electrolyzer to continue producing zero-carbon hydrogen when one of these resources isn't available. Similarly, electrolyzers co-located with solar could also connect to the electrical grid so that they can take advantage of excess wind capacity, which is likely to occur at night when the solar plant is idled.

**Hydrogen Imports:** Although Connecticut has substantial renewable energy resources on its own, regional hydrogen transport infrastructure could allow the state to access larger amounts of lower-cost hydrogen. For example, onshore wind provides one of the lowest-cost feedstocks for hydrogen production in the Northeast, but wind resources in Connecticut are extremely limited (and in the Low Case scenario, fully committed for decarbonization of the state's electricity sector). Importing hydrogen produced in states with more access to these lower cost wind resources (e.g., New York or Maine) could provide cost advantages if low-cost delivery is enabled via a regional pipeline network.

**Direct Grid Connections:** As Connecticut's electric sector decarbonizes in line with its climate targets, it may be possible to produce clean hydrogen with zero-carbon grid power (e.g., hydroelectric power). This would significantly increase electrolyzer capacity factors compared to systems tied to specific renewable energy installations, potentially allowing for the production of clean hydrogen under $2/kg in 2040. However, this is dependent on several conditions, including:

1. The ability for electrolyzers to access electricity tariffs close to wholesale prices, e.g., as a transmission service customer or other specialized rate plan.
2. The sufficiency of regional grid capacity to service electrolyzers without significant upgrades.
3. The ability to certify this hydrogen as "clean" given varying generation sources on the ISO-NE wholesale market.

Investigation into other potential production methods for hydrogen that could yield additional cost advantage could be considered based on Connecticut's state goals and decisions on how clean hydrogen in the state will ultimately be defined.

#### 4.1.4.2 | Recommendations

The findings outlined above suggest a number of steps that can be taken to support the development of a clean hydrogen supply for Connecticut and ensure that the hydrogen production does not conflict with the states existing climate goals. These are described in more detail below.

+ **DEEP should continue to evaluate the sufficiency of zero-emission electricity sources to meet both electric sector decarbonization goals and hydrogen production targets.** These evaluations should be incorporated into both existing state planning processes, as well as regional coordination about strategic resources such as offshore wind.
+ **DEEP should investigate accounting mechanisms that encourage hydrogen producers to certify the carbon intensity of produced hydrogen.** This is important to encourage hydrogen to be produced by renewable energy installations that may present colocation challenges, such as offshore wind and hydroelectric power. Without a mechanism that certifies that hydrogen is produced with zero-carbon electrons, it may be difficult for clean hydrogen production that is not directly connected to a renewable energy installation to qualify for federal tax credits (in addition to any other state incentives that may apply). If RECs are used at all as part of this accounting mechanism, steps should be taken to ensure that these RECs are retired directly by the hydrogen producer to avoid double counting.

+ **PURA should consider whether existing renewable energy, flexible and/or interruptible load tariffs could be applied to electrolytic hydrogen production and determine if a specific electrolytic tariff would be required.** Today, the high cost of electrolyzer operation is a significant driver of end-user hydrogen costs. Retail electricity rates are often not economically feasible to use for hydrogen production with electrolyzers. By enabling the use of grid supplied electricity via tariff to increase electrolyzer capacity, specialized tariffs can lower the overall cost of production and could drive Connecticut hydrogen market development. Note that appropriate renewable energy certificate structures would be required to ensure the climate integrity of this hydrogen. Similar electrolytic hydrogen tariffs have been deployed to accelerate hydrogen adoption for mobility in Washington[115] and Arizona.[116]

#### 4.1.4.3 | Stakeholder Feedback

Overall, there was broad support among stakeholders for an approach that assumed hydrogen production was in addition to other decarbonization needs. Environmental Advocates pointed out that, when possible, it is generally more efficient to use electricity from renewable energy directly to electrify buildings or transportation.[117] In addition, Bernard Pelletier expressed a preference for producing hydrogen from excess renewable energy to prevent clean energy from being "wasted." They noted that seasonal differences in clean energy production, as well as the large amount of offshore wind energy that's planned to be installed, would make curtailment a significant concern in the future.[118]

In addition, industry stakeholders weighed in on hydrogen production methodologies for Connecticut. FuelCell Energy noted that in-state hydrogen production is preferential from an economic development standpoint and also because transporting hydrogen adds costs and emission, so production as close as possible to end use is generally preferable. FuelCell Energy acknowledged that Connecticut may benefit from an open market that allows the state to import as well as export hydrogen.[119] Zone Flow also presented a technoeconomic analysis of their technology, stating that hydrogen produced from steam methane reformation with carbon capture and storage is the lowest-cost and nearest-term production method available for Connecticut.[120] Eversource advocated for the recommendation of direct legislative support for production, sale, and distribution of hydrogen.[121] Regarding the production of hydrogen via grid connected electrolyzers, Nel Hydrogen noted that the grid will become greener with time based on the number of states driving to carbon neutrality, and grid connected electrolysis projects will take time to develop and install, so the current grid mix should not be the only factor in determining the carbon intensity of hydrogen at a given location.[122]

Nel Hydrogen also provided feedback regarding hydrogen certification mechanisms. Nel noted that there are current efforts to implement hourly matching of renewable credits to certify hydrogen or require new committed installations of solar or wind for an electrolyzer project. They noted that hourly matching was deemed impractical in Europe and further explained that renewable projects do not follow the same timeline as hydrogen projects. Nel emphasized that these methods may slow hydrogen progress and highlighted that incentivizing early hydrogen with a plan to transition installations to lower carbon intensities over time is a preferred approach.[121]

Finally, several stakeholders weighed in on potential definitions of clean hydrogen, which is further discussed in Section 4.2.1.

115 City of Tacoma (2021), Resolution No. U-11206 Electrofuel Service Pilot (Schedule EF).
116 Arizona Corporation Commission (2021), Docket E-01345A-20-0367 Decision No. 77893.
117 Environmental Advocates (2022), Comments to the Hydrogen Task Force, p. 7.
118 Bernard Pelletier (2022), Comments to the Hydrogen Task Force, p. 1.
119 FuelCell Energy, Inc (2022), Comments to the Hydrogen Task Force, p. 5.
120 Zone Flow (2022), Comments to Hydrogen Task Force, p. 2.
121 Eversource (2022), Comments to the Hydrogen Task Force, p. 6.
122 Based on discussion with Nel Hydrogen.
123 Based on discussion with Nel Hydrogen.

### 4.1.5 | Recommendations for funding and tax preferences for building hydrogen-fueled energy facilities at brownfield sites through the Targeted Brownfield Development Loan Program.

#### 4.1.5.1 | Findings

Connecticut offers a wide range of funding opportunities that may be applied to support the remediation and redevelopment of brownfield sites into hydrogen-fueled energy facilities and other hydrogen infrastructure. However, it is important to note that no current state-level tax preferences or tax credits are associated with brownfield remediation or redevelopment.

The Targeted Brownfield Development Loan Program, along with a suite of additional programs and resources, is administered by the Office of Brownfield Remediation and Development within the Connecticut Department of Economic and Community Development. To qualify for these programs, sites under consideration must match the C.G.S. Sec. 32-760 definition of a brownfield: "any abandoned or underutilized site where redevelopment, reuse or expansion has not occurred due to the presence or potential presence of pollution in the buildings, soil or groundwater that requires investigation or remediation before or in conjunction with the redevelopment, reuse or expansion of the property."

Importantly, any applicants and potential development partners must have no direct or related liability for the conditions of the brownfield. The Targeted Brownfield Development Loan Program and the Brownfield Municipal Grant Program are both potential resources to support the remediation and redevelopment of brownfield sites to build hydrogen-related facilities and infrastructure.

**The Targeted Brownfield Development Loan Program** provides low-interest loan financing for the costs associated with the investigation, assessment, remediation, and development of a brownfield. Eligible entities for these loans include potential brownfield purchasers and current brownfield owners (including municipalities and economic development agencies, provided that a current owner did not contribute to any existing environmental contamination). The program has previously provided loans of up to $4 million with the following terms:

+ 3% interest;
+ Allowance for flexible deferred repayment to match projected cash flow with a maximum 30-year term; and
+ A minimum developer equity of 10%.

**The Brownfield Municipal Grant Program** is a competitive grant program for municipalities, municipal entities, and land banks that provides funding to assist with brownfield redevelopment projects that will drive significant economic impact. The program has a focus on public-private partnerships; for example, partnerships between a developer and an eligible municipal recipient. Remediation grants are limited to $2 million and assessment-only grants are limited to $200,000. Projects must go through a competitive selection round where they are scored based on a rubric that is defined for each funding cycle. In the most recent funding cycles, renewable energy projects have been given additional scoring credit. Projects should also demonstrate that the land is being put to the highest and best end use.

The municipal grant program has received an average of $15 million annually over the last few years, and DECD will be requesting $50 million for fiscal year 2023 and 2024.[124]

124 Connecticut Green Bank (2022), Hydrogen Power Study Taskforce: Funding Working Group Meeting #1.

Funding from brownfield loan and grant programs can be applied to the following costs associated with the investigation and redevelopment of a brownfield:

+ Soil, groundwater, and infrastructure investigation
+ Assessment
+ Remediation
+ Lead and asbestos abatement
+ Demolition
+ Hazardous materials or waste disposal
+ Long-term groundwater or natural attenuation
+ Other institutional controls
+ Attorney fees for environmental consulting
+ Planning, engineering, and environmental consulting
+ Building and structural issues
+ Environmental insurance

### Developing Brownfields for Energy Projects

A required end use of remediated and repurposed land is not specified by the programs; therefore, hydrogen-fueled energy facilities are currently eligible for funding. In fact, the Municipal Grant Program has already been deployed successfully for hydrogen-fueled energy facility projects. For example, a 14.9-MW fuel cell project was deployed in Bridgeport, Connecticut by Dominion Energy and FuelCell Energy utilizing remediation funding and financing from the Connecticut Green Bank.[125] The project provides reliable, clean power to Connecticut Light & Power and generates tax revenue, while repurposing a previously vacant lot.

Currently, some of the eligible sites for brownfield programs can be identified in the Connecticut Brownfields Inventory.[126] This inventory is not a comprehensive list of all potential Brownfields in the state, as many are not registered. It includes those which have received funding for assessment and/or remediation on the state or federal level, or have already been accepted into a liability relief program administered by DECD or DEEP.

While brownfield remediation and redevelopment funds are not applicable to direct costs of developing hydrogen-related infrastructure and facilities, they may be applied to pre-construction costs such as demolition of previous facilities, providing net financial benefit to project developers. Further research may be considered to assess the applicability of brownfield remediation and redevelopment funding to contribute to any relevant match funding requirements in the IIJA (more information on match requirements can be found in Section 4.1.3.1).

The Brownfield Redevelopment Programs typically require the full funding stack to be established before providing funding. However, a letter can be awarded to conditionally approve a project, contingent upon receiving the full stack of funding. This may be considered if the project is contingent upon potential competitive federal funding grants, such as those in the IIJA.

125 Sonal Patel, Power Magazine (2018), Dominion Sells 14.9-MW Bridgeport Fuel Cell Facility.
126 Connecticut DEEP, Connecticut Brownfields Inventory.

## CONNECTICUT'S WORLD LEADING FUEL CELL MANUFACTURING INDUSTRY: FUELCELL ENERGY SPOTLIGHT

FuelCell Energy

**US LOCATIONS:**
- Torrington, CT (Manufacturing)
- Danbury, CT (Research)

**EMPLOYEES:** 500+

**TECHNOLOGY:**
- *Molten Carbonate Fuel Cells (MCFC)* – Stationary Power Generation, Hydrogen and Carbon Capture Applications
- *Solid Oxide Fuel Cells (SOFC)* – Stationary Power Generation, Electrolysis and Energy Storage Applications

**PRODUCTION:** 100MW annual production capacity in Connecticut

**INSTALLATIONS:** 225MW installed globally, including 45MW in Connecticut

**APPLICATIONS:** Combined heat and power, carbon capture, and hydrogen production for: Utilities, Universities, Hospitals, Hotels, Mixed Residential-Commercial, Industrial, Retail, Ports, Micro-grids, Data Centers

**FUN FACT:** FuelCell Energy has a first of its kind in the world hydrogen project at Toyota's Port of Long Beach, CA. Fuel cells running on biogas will produce 2.3 MW power, 1400 gallons/day of water and 1200 kg/day of hydrogen to support port operations, car washing and fuel cell electrical vehicle fueling. FuelCell Energy is also partnering with Exxon to develop the only technology that can capture carbon dioxide while producing power at the same time.

### Opportunity for Additional Funding Under the Inflation Reduction Act

Under the Inflation Reduction Act, several of the tax credit programs for clean energy projects provide additional credit for projects that are sited in an "energy community", which is defined as:

+ "A brownfield site (as defined in… the Comprehensive Environmental Response, Compensation, and Liability Act of 1980).
+ An area which has (or, at any time during the period beginning after December 31, 1999, had) significant employment related to the extraction, processing, transport, or storage of coal, oil, or natural gas (as determined by the Secretary).
+ A census tract in which after December 31, 1999, a coal mine has closed, or after December 31, 2009, a coal-fired electric generating unit has been retired, or which is directly adjoining to any census tract described in subclause."[127]

However, it is important to note that the federal definition of a brownfield differs from the Connecticut definition, so it should not be assumed that all projects qualifying for the IRA brownfields energy communities tax credit would qualify for relevant Connecticut programs.

127 As defined in the Inflation Reduction Act Sec. 13101.

#### 4.1.5.2 | Recommendations

The Targeted Brownfield Development Loan Program and other brownfield programs represent an excellent source of funding to advance hydrogen-fueled energy facilities on remediated land, and the State could pursue specific steps to improve accessibility and use, including:

+ **DEEP and DECD should continue maintaining the Connecticut Brownfields Inventory as a resource for potential developers to identify prospective project sites and should consider expansion of the list to include those potentially eligible as "energy communities" under the Inflation Reduction Act.** This inventory can serve as a useful tool for developers in evaluating potential land availability. By expanding the inventory to include sites which may qualify as Brownfield "energy communities" (regardless of their eligibility under the state definition of a brownfield), Connecticut can further encourage developers to look at sources of funding — in addition to and beyond the state's programs — that support remediation of brownfields and advance the state's clean energy needs.
+ **DEEP and DECD should continue supporting development of clean energy projects on brownfields and projects that have community support and/or have completed community benefit agreements.** For example, DECD can encourage the use of their programs for clean energy projects by continuing to include renewable energy within competitive selection criteria. In recognition of the IRA incentives for siting projects on brownfields, stakeholder feedback indicated the potential for an increase in project development in these "energy communities". These Task Force participants raised the importance of ensuring that communities are provided appropriate channels for engagement on prospective projects.
+ **DECD should evaluate the need for additional funding for the Brownfield Loan and Grant programs to help meet the clean energy needs of the state and its subsequent land requirements.** The federal government has earmarked significant clean energy investment funding within the next decade, with some programs encouraging development in "energy communities", including brownfields. Connecticut's brownfield remediation and redevelopment programs may experience a significant increase in clean energy project proposals. The legislature may consider allocating additional funding to these programs that is specified for clean energy projects to ensure that local brownfield redevelopment projects may leverage federal opportunities without reducing other critical applications of the existing funding, such as affordable housing. The administrator of the brownfield programs, DECD, should consider this potential in upcoming budget requests.

#### 4.1.5.3 | Stakeholder Feedback

DECD, the brownfield program administrator, provided valuable feedback regarding the scope of the brownfield programs and informed stakeholders regarding project selection criteria and funding availability. DECD also noted that the brownfield programs require that selected projects demonstrate that they have a bankable business value proposition and are shovel ready. Notably, DECD also clarified that the brownfield programs are not applicable to direct costs of developing hydrogen related infrastructure and facilities, but they may be applied to pre-construction costs.[128] The team from DECD also explained that because of the broad definition of a brownfield, it is impossible to create a comprehensive list.[129]

The Environmental Advocates brought up concern about hydrogen infrastructure developments on brownfield sites. They pointed out that many of Connecticut's brownfields are located in environmental justice communities and distressed municipalities where residents are burdened by environmental harms from former and existing uses and infrastructure. The Environmental Advocates also highlighted that there are size constraints on using brownfields for hydrogen projects, explaining that most of the state's brownfields are less than five acres, too small for siting most hydrogen infrastructure. They further emphasized that siting hydrogen production, transport,

128 Connecticut Green Bank (2022), Hydrogen Power Study Taskforce: Funding Working Group Meeting #1.
129 *Ibid.*

or storage infrastructure on brownfields is not recommended due to safety, cost, and remediation criteria.[130] Alternatively, DECD noted that by definition, brownfield remediation can improve communities by cleaning up contamination in otherwise abandoned or underutilized sites.

An industry stakeholder, Nel Hydrogen, also recommended that DECD take a proactive approach in promoting brownfield sites as expansion opportunities for clean energy companies.

### 4.1.6 | Recommendations regarding funding sources for developing hydrogen fueled energy programs and infrastructure.

#### 4.1.6.1 | Findings

Broadly, the Funding Working Group considered State and Federal sources of potential hydrogen funding. At the federal level, significant funding is available beyond the IIJA to support hydrogen infrastructure, renewable resources, manufacturing and supply chains, workforce development, and research and development. At the state level, in recognition of the limited nature of state resources, stakeholders identified focused funding opportunities in high-impact areas.

**Federal Funding Opportunities**

The most significant federal opportunity for hydrogen market development is the IRA, which passed in September 2022 and directs $379 billion in tax credits and grant opportunities towards clean energy and climate provisions.[131] The IRA includes tax credit opportunities that are significant sources of non-competitive funding to support hydrogen fueled energy programs and infrastructure, some of which are detailed below.

**The Clean Hydrogen Production Tax Credit** provides a ten-year incentive to facilities that begin production by 2033, awarding up to $3/kg to produce clean hydrogen. Credits are determined based on carbon intensity of hydrogen production process on a life cycle basis (all qualifying hydrogen must be under 4 kg $CO_2e$/kg $H_2$). Importantly, to obtain full value of credit, the taxpayer must meet prevailing wage and apprenticeship requirements.

**The Investment Tax Credit** provides a tax credit to offset the capital expenses of hydrogen production facilities, stationary fuel cells, and energy storage (including hydrogen storage). The tax credit's value can reach 30%, with a base of 6%. The full credit will be achieved through ensuring prevailing wage and apprenticeship requirements are satisfied (for all projects larger than 1 MW) and by achieving lower carbon intensity. Additional credits are available for meeting certain conditions, such as utilizing domestic content and siting projects within "energy communities." This credit is available until 2024, after which it will turn into a technology-neutral "Energy Investment Tax Credit" (available through 2033).

**The Advanced Energy Project Tax Credit** extends a 30% incentive for qualifying energy projects, including manufacturing projects of fuel cell electric vehicles and electrolyzers.

**The Alternative Refueling Property Tax Credit** provides a 30% tax credit (capped at $100,000) for the cost of an alternative fuel vehicle refueling property placed in service before 2033 and can be applied to hydrogen refueling stations. These stations must be sited within a low-income or rural census tract area to be eligible.

In addition, the CHIPS and Science Act, passed in August 2022, may play an important role in creating opportunities for hydrogen in Connecticut. This law authorizes $174 billion for investment in science, technology, engineering, and math programs, workforce development, and research and development.

130 Environmental Advocates (2022), Comments to the Hydrogen Task Force, p. 6.
131 117th Congress (2021-2022), H.R.5376 Inflation Reduction Act of 2022.

Programs in the CHIPS and Science Act with direct references to hydrogen include:

+ $11.2 billion in funding for Department of Energy research, development, and demonstration activities is directed to support RD&D activities aligned with 10 technology areas in the energy offices, including hydrogen development.[132]
+ $800 million in grants to support the research, development, and demonstration of advanced nuclear reactors and specifies the prioritization of projects that support hydrogen production. This program is called Fission for the Future.[133]

Additional grants, financing, and other sources of funding that may be applicable to hydrogen in the Inflation Reduction Act and other federal programs are detailed in Appendix D.

### Potential Areas for State Funding Focus

In order to enable near-term progress, the Task Force identified end uses that are the highest priority for additional investigation (more information on end use prioritization can be found in Section 4.1.7). Priority end uses were selected on a variety of considerations, including their likeliness to use hydrogen due to underlying economics and their potential to have substantial societal benefits, such as pollution reduction. More information on end use evaluation can be found in 4.1.7.

Funding also represents an opportunity to advance areas that are important to the state, as well as emphasize areas of strength which can support Connecticut's competitiveness for federal grant opportunities. Stakeholder feedback throughout the Task Force and Working Group processes identified many key areas of strength that can differentiate Connecticut in the national and global market, including:

+ **A world-leading fuel cell and hydrogen equipment manufacturing industry:** Connecticut was named a "Top 3 State" for fuel cell development by the U.S. Department of Energy, ranking third in the nation in total fuel cell patents. The state estimates that at least 600 fuel cell and hydrogen supply chain companies are based in Connecticut, generating over $211 million in gross state product.[134]
+ **Hydrogen leadership and innovation in academia:** In New England, UCONN led the way as the first public R1 research university to sign onto the regional clean hydrogen hub effort.[135] This effort was led by UCONN President Radenka Maric, who brings over three decades of hydrogen and fuel cell research, deep experience in supporting technology innovation, and a track record of securing significant grant funding from the U.S. DOE. As of 2020, she had secured over $40 million in research funding.[136] This institution has demonstrated its readiness to support research, innovation, and workforce development in the emerging hydrogen ecosystem.

132 Bipartisan Policy Center (2022), CHIPS and Science Act Summary: Energy, Climate, and Science Provisions.
133 Pillsbury (2022), The CHIPS and Science Act Offers Support to Advanced Nuclear and Fusion Industries.
134 Connecticut Department of Economic and Community Development, Green Energy Overview.
135 Matt Engelhardt, UConn Today (2022), UConn Applies Clean Energy Expertise to Multi-State Hydrogen Hub.
136 Jessica McBride, UConn Today (2019), UConn Researcher Radenka Maric Named AAAS Fellow.

## CONNECTICUT'S WORLD LEADING HYDROGEN MANUFACTURING INDUSTRY: NEL HYDROGEN SPOTLIGHT

**LOCATION:**
Wallingford, CT (Manufacturing and Research)

**EMPLOYEES:** 130

**TECHNOLOGY:**
- *Proton Exchange Membrane (PEM) Water Electrolyzers*
- Alkaline Water Electrolyzers
- *Hydrogen Refueling Stations*

**PRODUCTION:** 75 MW currently, expanding to 500 MW by the end of 2024

**INSTALLATIONS:** 3,000+

**APPLICATIONS:** Transportation, Industrial Chemicals, Green Steel, Power, Refining

**FUN FACT:** Nel has a 20 MW solar to hydrogen PEM plant installation with Iberdrola (parent company to Avangrid) in Spain for green-ammonia production.


### 4.1.6.2 | Recommendations

To best align with requirements of federal funding sources, such as the IRA:

+ **Consider amending requirements for community benefit agreements, through Public Act 21-43, to lower the minimum project size from 2 MW to 1 MW, explicitly note the inclusion of hydrogen, and consider the development of similar requirements for all hydrogen projects.** Amending requirements in this way would align state requirements with those in the Inflation Reduction Act, ensuring that state projects are more likely to be eligible for federal benefits. This shift would also ensure that a broader range of clean energy projects would require agreements, leading to greater community alignment on projects. This recommendation is detailed further in Section 4.1.2.2.

To further support high-priority hydrogen end uses with state funding:

+ **DEEP and PURA may wish to consider promoting hydrogen end uses that are currently commercially viable through the existing clean energy programs including projects developed by both third parties and affiliates of the EDCs and LDCs. PURA's consideration should include how any changes would affect the programs' existing objectives and cost-effectiveness.** PURA's consideration should include how any changes would affect the programs' existing objectives and cost-effectiveness. Connecticut has a strong history of climate action, with many existing policies and programs that support their decarbonization goals. To integrate hydrogen most efficiently into the state's energy system toolkit, stakeholders recommend evaluating the existing structures that can be expanded to include hydrogen and its related infrastructure.

+ **The Legislature should consider tax exemptions for hydrogen vehicles and critical facilities that produce or use clean hydrogen.** A tax exemption for hydrogen vehicles and critical facilities would provide support for high-priority end uses, such as heavy-duty vehicles, while supporting the state's existing decarbonization policy objectives. For example, the recently enacted Clean Air Act in Connecticut authorizes the DEEP commissioner to adopt regulations implementing California's medium- and heavy-duty motor vehicle standards.[137] This recommended tax exemption would support this end use transition.
+ **DEEP should identify and potentially expand clean transportation incentives to include on-site port handling equipment, harbor crafts, and ocean-going vessels, in collaboration with other state and federal agencies.** These end-uses are typically located in a cluster around ports, supporting the potential for shared infrastructure.

To further support Connecticut's areas of strength and competitive advantages:

+ **UCONN, working in collaboration with community colleges; vocational high schools; regional comprehensive universities; Workforce Investment Boards; trades with expertise in hydrogen technologies and relevant skillsets; labor-led workforce development programs and training programs; LDCs, EDCs, and other employers; and any other relevant workforce or training programs, should identify opportunities to support development of the hydrogen workforce and advance research and development in hydrogen electrolyzers and hydrogen fuel cells, and should identify resources and funding needs to implement and contribute to the development of a hydrogen roadmap led by DEEP.** Stakeholders noted the importance of UCONN's deep capabilities in hydrogen fuel cell and electrolytic technology research and innovation to support Connecticut's hydrogen economy. These recommended actions would build upon Connecticut's deep expertise and further position the state as a leader in clean hydrogen technologies for regional, national, and global market opportunities.
+ **UCONN should host a "learning laboratory" funded by the state which would include facilities (e.g., hydrogen production, hydrogen stations), and capabilities (e.g., fuel cell buses, stationary fuel cells) to host integrated technology demonstration projects, with the primary objective of addressing technical barriers to the deployment of fuel cells, hydrogen and other clean energy technologies.** The learning laboratory may be modeled from the example of the National Research Council of Canada which partners with industry to advance innovative research solutions from the lab to the marketplace.[138] This facility would work with industry, government, community colleges and local universities, and other partners to leverage resources and advance clean energy technologies to commercialization, while providing education and awareness of these technologies to Connecticut families and businesses.
+ **DECD should establish a Strategic Innovation Fund with bond funds to encourage RD&D that will accelerate technology transfer and commercialization of innovative products, processes, and services related to hydrogen with guidance from an Industry Advisory Board.** This program could provide funding to support clean hydrogen and fuel cell economic development in Connecticut and facilitate the growth and expansion of local businesses and industries. Further, this initiative would support the advancement of industrial research, development, and technology demonstration through collaboration between the private sector, researchers and nonprofit organizations and support workforce development for high value green jobs modelled after the Manufacturing Innovation Fund. The Strategic Innovation Fund Industry Advisory Board should leverage existing industry groups such as the Manufacturing Innovation Fund's advisory board or the Connecticut Hydrogen Fuel Cell Coalition.

137 Abigail Brone, CT Insider (2022), CT Enacts Clean Air Law to Shift State Vehicles to Electric.
138 Government of Canada, About the NRC.

+ **DECD and OPM should identify opportunities for tax incentives or programs to retain Connecticut's leadership in the electrolyzer and hydrogen fuel cell manufacturing industry and prevent offshoring of manufacturing in line with federal policy.** Given the global momentum for hydrogen, hydrogen fuel cell manufacturing can be a significant area for Connecticut's economic development and job creation. Further, the IRA provides additional tax credit for projects that utilize domestically manufactured goods, which may cause a significant demand for Connecticut's fuel cell products.[139]

#### 4.1.6.3 | Stakeholder Feedback

Several stakeholders have identified key incentives or funding needs that the legislature or state agencies could consider to encourage the growth of a Connecticut hydrogen economy. Eversource identified that financial incentives to develop and supply hydrogen within disadvantaged communities would encourage developers to prioritize the development of projects in these areas. Further, Eversource commented that financial incentives could be implemented to enable community acceptance, including tax credits, grants, and PILOT agreements, along with other mechanisms that have supported the deployment of various technologies in Connecticut.[140]

UCONN noted that supporting early-stage developments that are at a low technology readiness level would benefit the state and lead to the creation of new companies. Additionally, UCONN has noticed a funding gap for early-stage projects. They noted that in some cases, academic institutions have funds that are restricted and cannot be used on early-stage projects. Connecticut Green Bank also recommended that early-stage pre-commercial demonstrations of technology should be considered from an economic development perspective. Further, the Connecticut Green Bank and the University of Connecticut have emphasized UCONN's capabilities regarding fuel cell and electrolytic technology research and workforce development which may be leveraged for future research and investigation related to hydrogen in the state.[141]

Stakeholders had divergent perspectives regarding the recommendation for the Legislature to consider tax exemptions for hydrogen vehicles and critical facilities that produce or use clean hydrogen. Sierra Club, the Conservation Law Foundation, and the Acadia Center expressed that only high priority mobility end uses, such as heavy-duty trucking, should be included within this policy and there should not be tax exemptions for light duty hydrogen vehicles.[142] In contrast, FuelCell Energy and Toyota have expressed that light duty vehicles should not be excluded from a tax credit.[143] FuelCell Energy noted that as progress is made to build out hydrogen infrastructure, light duty hydrogen vehicles may become a viable approach to decarbonization.

Further, stakeholders commented on the significant support from the federal government but noted key gaps that the state could address. Specifically, Eversource noted that as most federal funding would support the production of clean hydrogen, the State could focus on removing barriers to customer adoption including workforce training, as well as fostering the end use of clean hydrogen in low-income and EJ communities, which would help to further drive the development of clean hydrogen production in the state by ensuring a broad-based demand.[144] FuelCell Energy noted that the state should consider how it can support manufacturing of hydrogen generating technologies up to and including incentives to expand in-state manufacturing, transport, fueling and storage infrastructure, and how to incentivize end users.[145]

139 David E. Bond, White & Case (2022), New US Climate Bill Seeks to Promote Domestic Content in Clean Energy Projects.
140 Eversource (2022), Comments to the Hydrogen Task Force, p. 2.
141 *Ibid*.
142 Connecticut Green Bank (2022), Hydrogen Power Study Task Force: Sources and Uses Working Group Meeting #4 Meeting Minutes.
143 Connecticut Green Bank (2022), Hydrogen Power Study Task Force: Policy and Workforce Development Working Group Meeting #4. and based on discussion with FuelCell Energy.
144 *Ibid*.
145 FuelCell Energy (2022), Comments to the Hydrogen Task Force, p. 6.

Some stakeholders also suggested considering increases in caps on existing clean energy programs, which already support fuel cell projects, as these changes could enable deployment to meet decarbonization policy objectives.[146] For example, PURA and the Program Administrator Utilities, Eversource Energy and United Illuminating, may consider increasing their 10 MW cap on the Non-Residential Renewable Energy Solutions Program. This program increases the business value proposition for hydrogen fuel cells to support critical facilities and would support market development.

Stakeholders have brought Connecticut's key competitive advantages to the forefront. Industry stakeholders including Nel Hydrogen, FuelCell Energy, HyAxiom, and Infinity have noted that Connecticut's fuel cell manufacturing capabilities uniquely position Connecticut in the hydrogen industry. They have noted that the fuel cell manufacturing industry will be an opportunity for job growth and can be leveraged as the hydrogen industry grows globally.[147] The Conservation Law Foundation has indicated hesitancy to support the hydrogen fuel cell manufacturing industry with taxpayer dollars as it is already a mature and thriving industry.[148] HyAxiom and Nel Hydrogen noted that although the Connecticut fuel cell industry is impressive, it is important to have legislative support to help the industry grow as competition also increases.[149] Alternatively, Sierra Club noted that the fuel cell industry is already subsidized by ratepayers, and recommended clarity in manufacturing recommendations to ensure that investments will go towards clean hydrogen.[150,151]

Environmental stakeholders noted that although additional tax credits are available for siting facilities in "energy communities" and low-income communities to create economic opportunity and enable adoption of clean energy, Connecticut should ensure robust community engagement to ensure input on whether communities would like to host these facilities.[152] Sierra Club also generally cautioned the Task Force to not incentivize hydrogen uses that increase greenhouse gases and $NO_x$ emissions.[153] Finally, Sierra Club noted that since the information from Public Act 21-43 is relatively new, it is important to see how communities respond and if it strengthens community engagement. As an example, they noted that although all the developers are required to publicize the public meetings for the community, there is not currently decision making coming from the community.

UCONN noted the potential challenges for community engagement as envisioned, and emphasized that implementation of engagement structures needs to be easy for towns so that they do not become a burden. They noted the need to work on great implementation policies at the local level, especially given that most development decisions in Connecticut are done at the local level by parties such as the towns' planning and zoning committees.

### 4.1.7 | Recommendations for potential end uses of hydrogen-fueled energy.

#### 4.1.7.1 | Findings

Hydrogen has the potential to be used as a tool for decarbonization across many difficult to decarbonize sectors. In evaluating potential end uses for hydrogen, Strategen analysis considered the viability of hydrogen use in Connecticut across eight different criteria:

+ Cost-competitiveness compared to alternative decarbonization options;[154]
+ Potential to reduce in-state greenhouse gas emissions;

146 Connecticut Green Bank (2022), Hydrogen Power Study Task Force: Funding Working Group Meeting #3.
147 Connecticut Green Bank (2022), Hydrogen Power Study Task Force: Funding Working Group Meeting #4.
148 Based on conversations with the Conservation Law Foundation.
149 Connecticut Green Bank (2022), Hydrogen Power Study Task Force: Sources and Uses Working Group Meeting #4.
150 *Ibid.*
151 *Ibid.*
152 Connecticut Green Bank (2022), Hydrogen Power Study Taskforce: Funding Working Group Meeting #3.
153 Connecticut Green Bank (2022), Hydrogen Power Study Task Force: Funding Working Group Meeting #2.
154 In the discussion of alternative methods of decarbonization compared to fuel cells, the term electrification is used to refer to battery electric vehicles.

+ Timeline for commercial deployment;
+ Need to build out additional supporting infrastructure;
+ Ability to reduce pollution impact to disadvantaged and frontline communities;
+ Impact on local workforce needs; and
+ Value of improving resilience via a diversified fuel supply.

## CONNECTICUT'S WORLD LEADING FUEL CELL MANUFACTURING INDUSTRY: HYAXIOM SPOTLIGHT

HyAxiom
A Doosan Company

**LOCATION:**
South Windsor, CT (Manufacturing)

**EMPLOYEES:** Approx. 300

**TECHNOLOGY:**
- *Phosphoric Acid Fuel Cell (PAFC)* – Stationary Applications
- Proton Exchange Membrane Fuel Cells (PEMFC) – Investing for Transportation Applications
- *Polymer Electrolyte Membrane Electrolysis Cells (PEMEC)* – Researching for Electrolyzers

**PRODUCTION:** 200 MW annually with 30% in Connecticut and 70% in South Korea

**INSTALLATIONS:** 568 MW with 90% in South Korea and 10% in USA (with 22 MW in CT)

**APPLICATIONS:** Utilities, Universities, Hospitals, Hotels, Mixed Residential-Commercial, Industrial, Retail and Data Centers

**FUN FACT:** HyAxiom was formed by combining technology from UTC Power and the commercialization capability of Doosan.

A robust literature review focused on cost-competitiveness revealed that hydrogen represents a cost-effective zero-carbon fuel for many end uses that have not yet decarbonized. This cost-competitiveness assessment is described in greater detail in Appendix A. Some of these end uses can economically convert to hydrogen fuel today, while others will likely become economic as delivered costs of hydrogen decline due to state and federal infrastructure investment. Some end uses will likely not be commercially ready in the near-term (i.e., before 2030), but are important to consider as hydrogen-based fuels currently present the most technically feasible approach to decarbonization.

Based on a review of latest research, as well as insights and feedback from stakeholders, Strategen developed a qualitative assessment of each end use across the identified criteria, which was used to inform further recommendations. In general, hydrogen was found to be a particularly cost-effective option for transportation applications that required long periods of use and had limited refueling time. It could also provide significant value in stationary applications where power was needed on-demand and for prolonged periods of time. A list of and description of each end use that was considered is provided below, with more details provided in Appendix A.

## TABLE 4. SUMMARY OF END USES CONSIDERED IN ANALYSIS

| End Use | End Use Description | Justification for Consideration |
|---|---|---|
| **Aviation** | The use of hydrogen directly on airplanes in fuel cells, or to produce synthetic kerosene from clean hydrogen and carbon-neutral CO2 sources. | Outside of biofuels (which have supply limitations when used at scale), hydrogen-based fuels offer the only technically viable decarbonization solution. |
| **Maritime** | Liquified or gaseous hydrogen use on ships in fuel cells, or hydrogen converted to methanol or ammonia. | The majority of carbon-free shipping will need to employ one of these three options, as electrification of transoceanic shipping is technically infeasible. |
| **Heavy-Duty Trucks** | The use of hydrogen in fuel cells on any vehicle over 26,000 lbs. | Due to their irregular scheduling, low down times, and heavy loads, hydrogen presents a wide range of benefits for this end use compared to electrification. |
| **Light-Duty Vehicles** | The use of hydrogen in passenger vehicles and pick-up trucks. | Hydrogen has been proposed by some industry stakeholders as a pathway to decarbonize light-duty transport, and several passenger fuel cell vehicle models exist today. |
| **Buses** | The use of hydrogen in fuel cells on buses. | Hydrogen provides similar benefits for buses as for heavy-duty trucks, with highest benefits for buses that travel long distances (e.g., >400 miles per day). |
| **Material Handling Equipment** | The use of hydrogen fuel cells in forklifts and similar equipment. Applications exist within warehouses, stores, ports, and other facilities. | Fuel cells in forklifts realize benefits such as fast refueling, increased performance, and reduced space needs for refueling infrastructure. |
| **Industrial Heat** | Hydrogen combusted to provide heat for industrial processes. | In addition to biofuels, hydrogen is one of the primary options considered for heat applications that cannot be economically electrified. |
| **Residential / Commercial Heat** | The use of hydrogen to provide space heating for residential and commercial buildings. | Hydrogen can be combusted for heat like natural gas, although 100% hydrogen use would require large-scale retrofits of pipelines and equipment. |
| **Hydrogen Blending** | Hydrogen blending into existing natural gas feedstocks for industrial processes, or in the general pipeline network. | If blend levels are kept low, equipment retrofits can be avoided. (*See Note on Hydrogen Blending below*) |
| **Dispatchable Power Generation** | Using hydrogen to produce electricity for peak power applications, either via a fuel cell or combustion turbine. | Dispatchable carbon-free generation is valuable on grids with high penetrations of renewables. This use case also allows hydrogen to serve as “seasonal storage” and produced from renewable energy that would otherwise have been curtailed. |
| **Critical Facilities** | The use of hydrogen fuel cells to provide back-up power at hospitals, data centers, and other facilities that require long-duration back-up power (i.e., 24+ hours). | Power is required on-demand and for durations that are difficult to achieve with solar plus battery storage solutions. |
| **Rail** | The use of hydrogen on locomotives in fuel cells. | Hydrogen can provide an attractive alternative to battery electrification for rail cars that travel long distances. |
| **Harbor Craft** | Using hydrogen in fuel cells to power regional ferries and other localized port vessels. | Dedicated refueling locations provide the possibility of convenient hydrogen refueling. |
| **Specialty Vehicle Fleets** | Special-purpose vehicles that have long uptimes and dedicated refueling infrastructure, like police cruisers or ambulances. | Charging limitations from long uptimes may make electrification challenging for these applications. |

### Note on Hydrogen Blending

Hydrogen can be blended directly into natural gas feedstocks at industrial facilities or blended into the gas network for delivery to all customers connected to that network. Testing conducted in Europe has found that hydrogen blends up to 15 or 20% by volume (5-7% by energy content) are possible without requiring substantial retrofits of existing infrastructure or equipment.[155] However, capacity for hydrogen blending can vary based on local grid conditions, and state-specific testing is recommended to ensure compatibility with existing infrastructure. For example, a recent study in California was only able to verify the safety of 5% hydrogen blends by volume in the state's gas distribution system, noting that additional demonstration projects would be required to ensure at-scale viability.[156]

Hydrogen blending for non-core customers (e.g., industrial or power generation customers) could be done at the facility level due to the large, concentrated demand for natural gas that exists at these facilities. This would require an assessment of the customers' facility to determine that hydrogen can be blended directly into their fuel feedstock without affecting operation or increasing pollutant emissions from their facility. However, because this use case focuses blending at individual customer facilities, this assessment would likely not need to assess the impact of hydrogen blending on the wider gas network.

Even blending hydrogen only at non-core customer facilities would create significant demand for hydrogen in the short term. For reference, blending hydrogen into the natural gas feedstocks for two gas plants located in Bridgeport (i.e. Bridgeport Energy and Bridgeport Harbor Station) at a ratio of 10% hydrogen by volume in 2030 could use close to 7.6 kt of hydrogen.[157] This would require around 410 GWh of electricity to produce, or roughly the amount renewable energy that would otherwise be curtailed by the state in that year.[158] As hydrogen production increases, these facilities could be fully decarbonized by retrofitting them with turbines that can burn 100% hydrogen or replaced with fuel cells that can operate on 100% hydrogen.

Hydrogen can also be delivered to non-core customers by blending it into the main gas network. However, this would also deliver hydrogen to all customers connected to the gas network, including residential and commercial customers. This approach would require a broader assessment to understand how hydrogen would interact with the gas distribution system in Connecticut, which would likely take longer than facility-level assessments. As a result, in this report, "hydrogen blending for non-core customers" refers primarily to blending done at the facility level, as this is a more directed and less technically demanding approach to supplying hydrogen to these end users.

155 Raju, Arun SK and Alfredo Martinez-Morales (2022), University of California, Riverside, Hydrogen Blending Impacts Study.

156 *Ibid*.

157 S&P Capital IQ (2022), "Screening and Analytics: Gas power plant net generation in Connecticut in 2021" and Connecticut Department of Energy and Environmental Protection (2021), 2020 Integrated Resources Plan: Appendix 3 Results.

158 Based on curtailed electricity estimates provided in ISO-NE's Pathways Report. See Appendix C for more details.

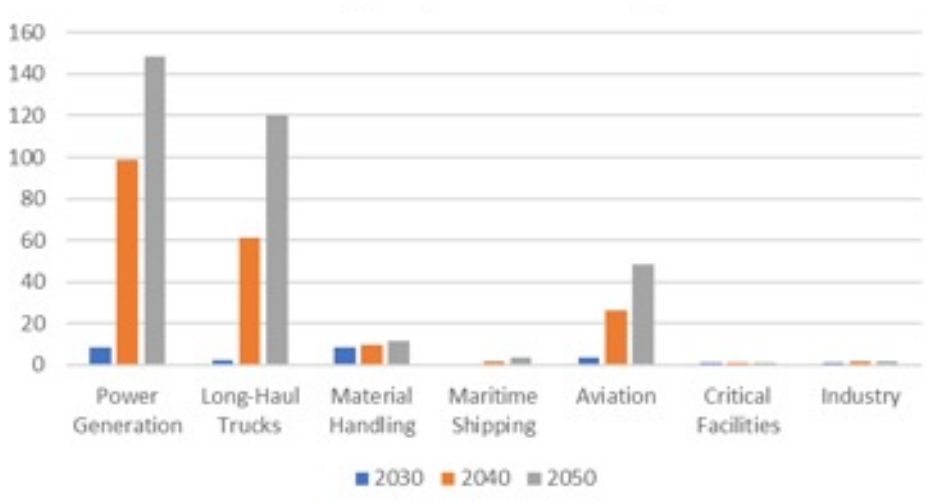
### Hydrogen Demand Analysis

To better understand the potential demand for hydrogen in Connecticut, Strategen assessed the scale of hydrogen use that could be expected in the highest priority end uses (see Recommendations section for more details on end use prioritization). Similar to the hydrogen supply analysis, this assessment was designed to reflect maximum potential demand estimates, identifying the largest possible hydrogen demand that could feasibly be required by highest priority end uses over the next three decades. The rationale for focusing on maximum potential demand was twofold:

1. To determine if state-specific clean energy resources could fully cover demand in ambitious adoption scenarios.
2. To understand what economies of scale Connecticut could potentially realize in the development of hydrogen infrastructure.

Using this approach, this assessment found that hydrogen demand could scale up from 25.2 kilotonnes (kt) per year in 2030 to 200.5 kt/year in 2040 and 335.5 kt/year per year in 2050. The annual production in 2050 would require around 18.1 TWh of electricity, which represents slightly less than 10% of the technical production capacity of state-specific clean energy resources identified in the Hydrogen Mid Production Case, indicating that state-specific clean energy resources could feasibly meet all priority hydrogen demand. This demand could drive around 12.8 GW of additional fuel cell capacity in the state by 2050, driven primarily by demand for fuel cells in long-haul trucking and power generation.

**FIGURE 10. POTENTIAL ANNUAL HYDROGEN DEMAND BY SECTOR**

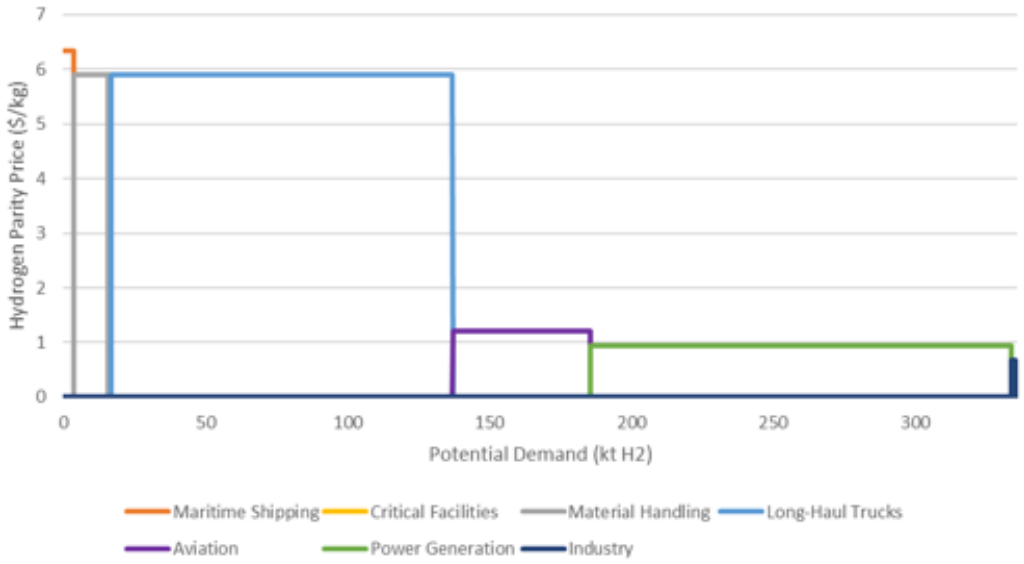



**Source:** Strategen Consulting

Additionally, to assess the economic conditions under which different industries would be most likely to transition to hydrogen, price points were calculated at which hydrogen would reach cost parity with the traditional fuel choice in each end use. The price levels were determined by identifying the volume of the traditional fuel that would deliver the same amount of energy as a kilogram of hydrogen in a specific application, taking into account the efficiency of fossil fuel equipment (e.g., internal combustion engines) relative to hydrogen technology (e.g., fuel cells). In other words, if hydrogen were priced underneath levels described in this chart, then it would cost end users less to purchase hydrogen than the fossil fuel alternative.

Although ultimate end user decisions will be determined by a number of considerations not accounted for in this analysis (such as the capital costs of underlying equipment and policy pressures to adopt carbon-neutral solutions), these prices serve as a proxy for the point where different sectors may begin to transition their operations to hydrogen. The prices represent the final delivered cost of hydrogen, inclusive of all transportation and storage costs, which can vary across end uses. In stationary applications, they typically include the cost of hydrogen pipelines, compression stations, and storage. For distributed transportation applications like long-haul trucking or material handling, the costs of liquefaction and truck delivery may also be included in the final cost of hydrogen. More details around the infrastructure costs are provided in subsequent sections.

**FIGURE 11. HYDROGEN DEMAND CURVE FOR 2050**




**Source:** Strategen Consulting

#### 4.1.7.2 | Recommendations

Based on the above analysis, several end uses were identified as high priority opportunities to leverage hydrogen to reduce greenhouse gas and local pollutant emissions while simultaneously stimulating economic development standpoint within Connecticut. Additional consideration of these end uses by the legislature would be valuable from both an environmental and economic development, with higher-priority end uses providing an opportunity for supportive policy to play a role in developing local and regional markets.

The recommendations in this section are divided across three prioritization tranches for end uses, which are described in more detail below:

+ **DEEP should consider further investigation and the possibility of focused policy and market development support for hydrogen use in highest priority end uses.** The highest priority end uses includes those where (1) technical considerations make it highly likely that hydrogen will be used, (2) hydrogen use is particularly economic and (3) hydrogen use could create significant societal benefits due to the scale of the industry (via GHG emission reductions, workforce development, etc.). As a result, these applications present "least regrets" opportunities for policy support, and state-level or regional policy coordination has the potential to play a catalytic role in scaling up hydrogen use across several of these sectors. The highest priority end uses are as follows:
  - Aviation (long- and medium-haul)
  - Cargo ships
  - Critical facilities (24-hour backup need)
  - High heat industrial processes
  - Hydrogen fuel cells for peak power generation
  - Long-haul heavy-duty trucks
  - Material handling equipment with long uptimes and charging space constraints
+ **DEEP should consider further investigation into high priority hydrogen end uses and the possibility of coordinating support measures with other hydrogen efforts.** This includes smaller-scale end uses where hydrogen could be an economic decarbonization solution depending on the local needs and conditions. Hydrogen transitions for these end uses can be a good option to consider on a case-by-case basis, particularly if there are opportunities for these end uses to share hydrogen infrastructure that is developed for other applications.
  - Long-distance buses
  - Localized harbor craft (e.g., ferries)
  - Freight rail
  - Hydrogen blending for non-core customer[159] (i.e., power generation and industrial heat)
  - Specialty fleet vehicles with long uptimes and specific refueling locations
  - Heavy-duty vehicles with charging constraints[160] (e.g., drayage trucks, some commuter buses)
+ **PURA should evaluate the role of stationary hydrogen fuel cells for critical backup power and peak power generation and identify approaches to incorporate recommendations into appropriate planning venues.** Fuel cells for power generation are already in place today and can potentially be incorporated into demand response programs and specialized tariffs that encourage transition to 100% hydrogen systems. Fuel cells in for power generation can be incorporated into system planning to service load pockets facing grid constraints, with eventual incorporation into system planning to provide seasonal storage on a fully decarbonized grid.

159 Refers primarily to blending hydrogen into natural gas feedstocks at industrial facilities. Delivery to non-core customers could also be achieved by blending hydrogen into the broader gas system, but this would deliver equivalent levels of hydrogen to all customers on the system (including residential and commercial customers).

160 Refers to buses or other heavy-duty vehicles where electrification would require costly upgrades to local electricity infrastructure, or where space constraints or other obstacles may hinder the use of battery vehicle charging (e.g., at ports or densely urbanized areas).

#### 4.1.7.3 | Stakeholder Feedback

Working Group participants were particularly engaged on topics related to hydrogen end uses, and the diverse range of stakeholder feedback was instrumental in the development of this analysis and recommendations.

Stakeholders provided support for the concept of end use prioritization. The Nature Conservancy stated that the need to move rapidly towards sector-wide decarbonization, electrification, and energy efficiency does not allow any potential energy options to be ignored. They noted that there is a need to establish the right priorities for hydrogen use. PURA also noted their support for the draft prioritization framework established by the Uses Working Group as presented at the November 8, 2022 Task Force meeting.[162]

A number of stakeholders also weighed in on criteria that should be considered in this prioritization. FuelCell Energy recommended consideration for how quickly each end use can grow in size as a source of hydrogen demand, and how effectively the end use supports decarbonization, as well as other air quality (e.g., criteria pollutants) and environmental justice goals. PURA recommended prioritizing end-uses that are difficult to decarbonize and provide meaningful societal benefits.[163] The Nature Conservancy also noted several criteria for end use prioritization – cost, safety, efficiency, and environmental preservation.[164] Additionally, the Environmental Advocates detailed a set of criteria developed by EarthJustice to guide end use prioritization.[165]

There was significant stakeholder feedback on which end uses should be placed in which priority buckets. CCAT recommended that applications that have multiple values to Connecticut communities, industry, energy reliability, and workforce should be considered for prioritization.[166] Eversource noted that the building sector and portions of the transportation sector could be near-term focus areas for hydrogen use, and FuelCell Energy noted that light duty hydrogen fuel cell vehicles can be a significant source of hydrogen demand.[167] By contrast, the Environmental Advocates stated that hydrogen does not make economic sense as a decarbonization strategy for light-duty vehicles or buildings and affirmed that the deployment of clean hydrogen should be limited to hard-to-decarbonize applications that cannot easily or cost-effectively be electrified.[168] They identified that hydrogen potentially makes sense as a road transport fuel in the limited context of heavy-duty long-haul trucking.

Eversource identified that technology and market factors have set the conditions necessary to begin electrification of a large portion of transportation applications, including the expected mass adoption of passenger electric vehicles, last mile/local delivery vehicles, transit and school buses, and fixed route industrial applications like refuse trucks, but there remains a group of transportation applications that are considered difficult to electrify, including long-haul trucking, aviation and maritime shipping which may be appropriate for hydrogen.[169] FuelCell Energy identified blending as a near term hydrogen end use as it decarbonizes multiple sectors that require high Btu/ high grade heat in their process of making products and/or delivering services.[170] FuelCell Energy also noted that Connecticut should support other end uses which have potential benefits, such as hydrogen power generation, material handling, and light- and heavy-duty vehicles.[171]

162 Connecticut Public Utilities Regulatory Authority (2022), Comments to the Hydrogen Task Force, p. 5.
163 *Id.*, p. 4.
164 The Nature Conservancy (2022), Comments to the Hydrogen Task Force, p. 4.
165 Environmental Advocates (2022), Comments to the Hydrogen Task Force, p. 9.
166 Connecticut Center for Advanced Technology (2022), Comments to the Hydrogen Task Force, p. 5.
167 FuelCell Energy Inc (2022), Comments to the Hydrogen Task Force, p. 4.
168 Environmental Advocates (2022), Comments to the Hydrogen Task Force, p. 7.
169 Eversource (2022), Comments to the Hydrogen Task Force, p. 4.
170 FuelCell Energy Inc (2022), Comments to the Hydrogen Task Force, p. 4.
171 *Ibid.*

Stakeholders also noted the omission of hydrogen as a long duration energy storage (LDES) solution. [172,173] This spoke to a lack of clarity in the initial presentation of end uses because the use of fuel cells for peak power generation represents a LDES application, as hydrogen's function as LDES is typically accomplished by producing hydrogen from excess renewable energy and then converting it pack to electricity (via fuel cells or combustion turbines) to meet peak power demand when renewable energy is not available.

There was also significant discussion of the appropriate end uses to prioritize within working group meetings. CCAT expressed concern that some end uses identified as "highest priority" would be particularly difficult for Connecticut to address. This included hydrogen use for long-haul trucks, maritime shipping, and aviation, which are integrated into regional transportation networks and so are challenging to address with state-specific policy. Toyota also stated that customer use patterns for passenger vehicles might make them difficult to address with electrification alone. Other stakeholders, such as the Acadia Center and Conservation Law Foundation, stated that hydrogen use should be concentrated on sectors that are hardest to electrify.

In general, there were two end uses that solicited a particularly large volume of stakeholder comments in working groups: commuter buses and hydrogen blending. The feedback on these two end uses is outlined in more detail below:

### Buses

There was substantial discussion in Uses Working Group meetings and follow-up communications about the value of hydrogen for use in buses, including municipal transit buses and other commuter buses that travel shorter routes (as well as other heavy-duty vehicles with shorter ranges). Stakeholders across several sectors supported the consideration of hydrogen for this end use, noting (for example) that battery electric buses are far heavier than fuel cell buses. This included representatives from DEEP, CCAT, and Avangrid.[174]

By contrast, Acadia Center opposed the uniform use of hydrogen in buses, noting in an email that some energy experts have concluded that electrification can be particularly cost-effective for buses with shorter driving ranges.[175] Overall, the diversity of this feedback illustrated that "buses" is not a monolithic end use, and that the usage profiles and local conditions are important to consider when deciding how to decarbonize this particular area of the economy. This feedback prompted the division of buses into several sub-categories, including long-distance buses and buses that operate in areas where local conditions may limit the feasibility of battery charging.

### Hydrogen Blending

The blending of hydrogen into existing natural gas pipelines and feedstocks was an area of focus for many stakeholders. Sierra Club pointed out that the technical limits of hydrogen blending meant that it could not completely decarbonize gas use,[176] and Acadia Center stated that hydrogen blending can't reduce gas system emissions to zero and so shouldn't be considered as a one-to-one comparison to options that fully eliminate users' on-site emissions (e.g., electrification).[177]

172 Bloom Energy (2022), Comments to the Hydrogen Task Force, p. 2.
173 Bernard Pelletier (2022), Comments to the Hydrogen Task Force, p. 1.
174 Connecticut Green Bank (2022), Hydrogen Power Study Taskforce: Uses Working Group Meeting #3.
175 Based on conversations with the Acadia Center.
176 Connecticut Green Bank (2022), Hydrogen Power Study Task Force Infrastructure Working Group #3.
177 Connecticut Green Bank (2022), Hydrogen Power Study Task Force Uses Working Group #1.

However, other stakeholders expressed support for testing hydrogen blending in the natural gas system. CCAT advocated for it as a way "store" hydrogen that is produced from renewable energy that would otherwise have been curtailed, allowing otherwise "wasted" renewable energy to reduce greenhouse gas emissions from gas networks. They also noted that this could provide a way to avoid "stranding" existing infrastructure, stating that investigating the use of hydrogen in energy infrastructure was a primary goal of the Task Force set out in Special Act 22-8.[178]

Finally, there was concern that the distinction between hydrogen blending for core and non-core customers was overly nuanced and confusing. Acadia Center stated that applications where hydrogen is blended at individual customer facilities, such as those that use high heat processes, is fundamentally different than those where it is blended into the entire gas system for all customers, and that these two applications should be treated separately.[179]

# 4.2 | Additional Findings and Recommendations

In addition to the statutorily mandated areas of research, the Task Force also investigated further foundational topics – defining clean hydrogen, understanding infrastructure needs, and identifying stakeholder engagement strategies – that must be understood to develop a clean hydrogen ecosystem in Connecticut.

## 4.2.1 | Identification of how to define clean hydrogen in Connecticut.

### 4.2.1.1 | Findings

Federal guidance from the proposed Clean Hydrogen Production Standard has established "clean hydrogen" as that with less than 4 kg of $CO_2e$/kg $H_2$ on a lifecycle basis (well-to-gate). The use of a lifecycle or carbon intensity-based definition of clean hydrogen removes ambiguity associated with the "colors of hydrogen" and provides a standardized methodology to assess hydrogen on a technology-neutral basis. A carbon intensity framework can adopt a threshold and certification scheme to rigorously account for greenhouse gas emissions arising both at the site of production and upstream of production.

While designations of clean, green, and renewable hydrogen are not necessarily interchangeable, it is helpful to understand how different jurisdictions have defined each of these terms to inform the development of a Connecticut specific definition of clean hydrogen. Prior to the U.S. Federal guidance on defining clean hydrogen, three U.S. states – Oregon, Washington, Montana – defined clean hydrogen in statute.

178 Connecticut Green Bank (2022), Hydrogen Power Study Task Force Uses Working Group #3 Meeting Minutes.
179 *Ibid.*

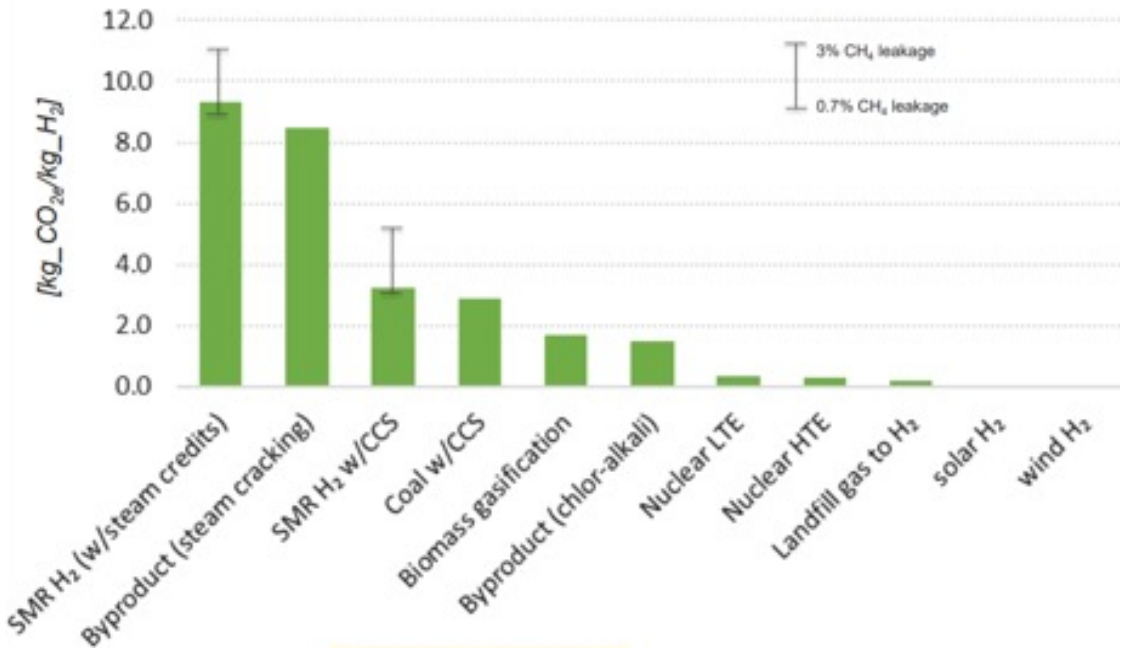
## TABLE 5. SURVEY OF NATIONAL AND INTERNATIONAL DEFINITIONS OF CLEAN, RENEWABLE, OR GREEN HYDROGEN

| | HYDROGEN TYPE (e.g., clean, renewable, green) | BASED ON A CARBON INTENSITY CALCULATION | TECHNOLOGY AGNOSTIC (e.g., includes biomass, biogas, electrolysis, nuclear) | ELECTROLYSIS WITH RENEWABLES ONLY | ELECTROLYSIS WITH RENEWABLES ONLY |
|---|---|---|---|---|---|
| US DOE | Clean | X | X | | |
| Montana | Green | | X | | X |
| Washington State | Renewable | | X | | |
| Oregon | Renewable | | X | | X |
| Australia | Clean | | X | | |
| Canada | Green | | | X | X |
| Canada | Low Carbon Intensity | X | X | | |
| Chile | Green | | | X | X |
| France | Renewable | X | | X | X |
| France | Low Carbon | X | X | | |
| Germany | Green | | | X | X |
| Sweden | Renewable/ Clean | X | X | | |
| CertifHy | Green | X | X | | X |
| CertifHy | Low Carbon | X | X | | |

Varying approaches have been taken for defining hydrogen based on a region's climate goals, technology development activities, and geographic considerations. Notably, federal guidance from the IIJA and Proposed Clean Hydrogen Standard provides a minimum standard that clean hydrogen must meet to access federal incentives, set at 2 kg $CO_2$e/kg $H_2$ at the point of production and 4 kg $CO_2$e/kg $H_2$ on a lifecycle basis.

The federal definition of clean hydrogen in the IIJA and Clean Hydrogen Production Standard enables production of clean hydrogen from a diversity of feedstocks. A study using the GREET model from Argonne National Laboratory identified the lifecycle carbon intensity associated with hydrogen production pathways and demonstrated that clean hydrogen as defined by the Clean Hydrogen Production Standard can be produced by diverse feedstocks, including nuclear, solar, wind, landfill gas, and even potentially fossil fuels with carbon capture and sequestration assuming minimal methane leakage.

**FIGURE 12. WELL-TO-GATE GHG EMISSIONS OF HYDROGEN PRODUCTION PATHWAYS**




**Source:** Argonne National Laboratory: GREET Model for Hydrogen Life Cycle GHG Emissions (June 15, 2022)

#### 4.2.1.2 | Recommendations

The development of a statewide definition of clean hydrogen would provide clarity for hydrogen development within Connecticut.

+ **DEEP should conduct further investigation to ultimately establish a definition of clean hydrogen that would be most appropriate for Connecticut.** While hydrogen can be produced from fossil fuels via steam methane reformation, from electricity via electrolysis, or from organic sources, these sources have differing levels of GHG emissions associated with production. Many countries and U.S. states have established definitions of clean, green, renewable, or low-carbon hydrogen to differentiate hydrogen with lower GHG emissions intensity (as shown in Table 5) and the federal government has similarly suggested a definition based on lifecycle emissions. Such definitions can provide clarity for hydrogen development within the state and will help to guide project and fuel eligibility for siting, funding, tariff regulation, and other actions and initiatives referenced in this report.

#### 4.2.1.3 | Stakeholder Feedback

Discussion regarding a definition of clean hydrogen revealed a range of opinions among stakeholders. Eversource, Bloom Energy, FuelCell Energy, and CCAT recommended alignment of the Connecticut definition for clean hydrogen with federal guidance.[180] Bloom Energy stated that consistent definitions are essential to ensure clarity in this developing sector and will enable more participation in federal tax incentives and innovation programs benefiting Connecticut ratepayers.[181] FuelCell Energy noted that Connecticut has several clean energy technology companies that serve broader national and global markets and stated that a definition consistent with the federal definition will enable broader economic development.[182]

The Environmental Advocates stated that Connecticut should pursue a more stringent definition for clean hydrogen than the one established by the federal government. They proposed that an appropriate state definition of clean hydrogen should include only hydrogen produced with zero-carbon renewable energy. The Environmental Advocates clarified that zero-carbon resources must be additional to prevent any double counting of their clean energy attributes. With a clean hydrogen definition that includes only non-fossil fuel, 100% zero-carbon feedstock, they also noted that having more stringent state requirements would not preclude Connecticut projects from obtaining federal funding, unless that funding is specifically for production methods or sources that would not qualify as clean hydrogen under a more stringent definition in Connecticut.[183]

Representatives from DEEP expressed the need for further investigation into what definition would be most valuable for Connecticut before recommending any specific definition and noted that such analysis will be undertaken throughout DEEP's Comprehensive Energy Strategy (CES) process.[184]

### 4.2.2 | An examination of the infrastructure needed for a clean hydrogen ecosystem.

#### 4.2.2.1 | Findings

Various types of infrastructure are required to enable the effective delivery of hydrogen to end users, including compression, storage, transportation, and in some cases, liquefaction. Hydrogen is produced at low pressures, between 20 and 30 bar, and must be compressed to between 200 and 500 bar to be economically transported.[185] Once compressed, hydrogen can be transported through pipelines or on trucks, as well as via more specialized transport methods like barges or rail. Hydrogen can also be liquefied for transportation on trucks, which allows for higher energy density by volume than gaseous hydrogen.

Another key piece of hydrogen infrastructure is storage. At small volumes, hydrogen can be held in smaller storage tanks at production or end-use sites. At large volumes, geologic storage sites provide the most economic means for hydrogen storage and can be used for long-term storage to balance any seasonal variation in hydrogen production from renewable energy. Salt caverns are the lowest-cost and commercially available form of geologic storage but are only present in specific locations. The map below shows the locations of known salt cavern storage in the US;[186] the closest sites to Connecticut are in Upstate New York and Pennsylvania, approximately 150 to 200 miles from Bridgeport, and would likely require a pipeline connection to access.

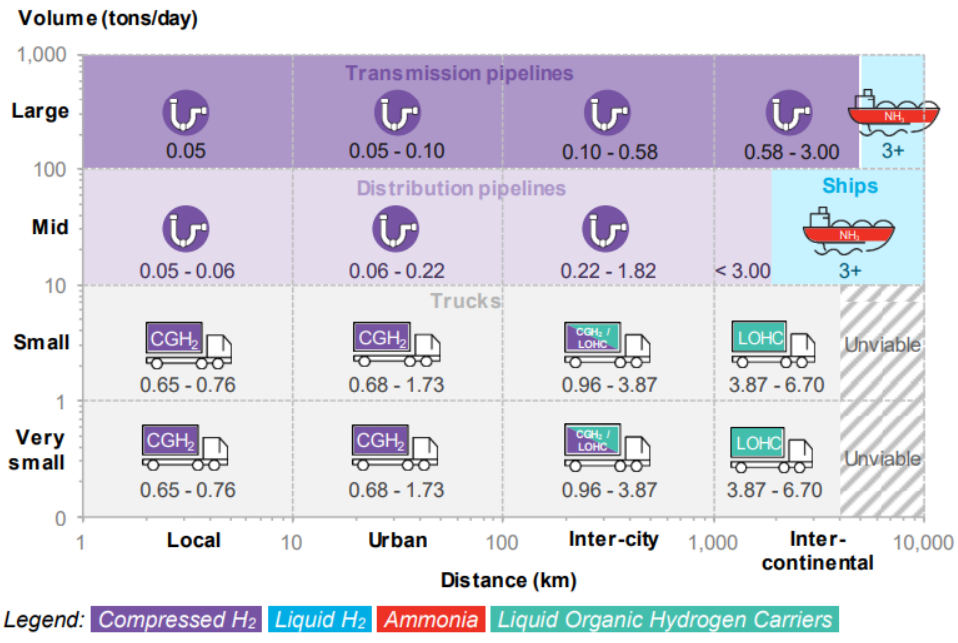
180 Eversource (2022), Comments to the Hydrogen Task Force, p. 1; Bloom Energy (2022), Comments to the Hydrogen Task Force, p. 1; FuelCell Energy Inc. (2022) Comments to the Hydrogen Task Force, p. 2; and CCAT (2022), Comments to the Hydrogen Task Force, p. 4.
181 Bloom Energy (2022), Comments to the Hydrogen Task Force, p. 1.
182 FuelCell Energy Inc. (2022), Comments to the Hydrogen Task Force, p. 2.
183 Environmental Advocates (2022), Comments to the Hydrogen Task Force, p. 3-4.
184 Connecticut Green Bank (2022), Hydrogen Power Study Task Force Policy Working Group #3.
185 U.S. Department of Energy Hydrogen and Fuel Cell Technologies Office, Gaseous Hydrogen Compression.
186 Lord et al., Sandia National Laboratories (2014), Geologic storage of hydrogen: Scaling up to meet city transportation demands.

## FIGURE 13. KNOWN SALT DEPOSITS IN THE CONTINENTAL U.S.

**Source:** Geologic storage of hydrogen: Scaling up to meet city transportation demands (September 23, 2014)

The cost-effectiveness of hydrogen transportation infrastructure varies according to both the volume of hydrogen and the distance over which the hydrogen is being transported. Figure 14 shows approximate costs for different forms of transportation.[187] Transmission pipelines are generally the lowest cost alternative for transporting large quantities of hydrogen over long distances. When transporting volumes over 100 kilograms per day, the average costs for transmission pipelines are between $0.05 to $0.10 per kilogram of hydrogen for distances up to 100 kilometers (or around 60 miles), and $0.10 to $0.58 per kilogram for inter-city distances on the scale of hundreds of miles.[188] These estimates include the cost of associated compression and storage.

## FIGURE 14. HYDROGEN TRANSPORTATION COSTS BY DISTANCE AND VOLUME ($/kg)




**Source:** Bloomberg NEF: Hydrogen Economy Outlook (March 30, 2020)

187 "Liquid Organic Hydrogen Carriers" refers to a novel way of transporting hydrogen via organic compounds that can absorb and release hydrogen through chemical reactions. They are not yet commercialized at scale, so this report has focused on liquid hydrogen as the most likely transport option for truck delivery over long distances.

188 BloombergNEF (2020), Hydrogen Economy Outlook.

There are approximately 1,600 miles of hydrogen pipelines currently operating in the United States, located in areas with high concentrations of large hydrogen users (historically petroleum refineries and chemical plants), such as the Gulf Coast.[189] Pipelines for hydrogen are similar to those used for natural gas transmission. However, hydrogen has a stricter set of material standards for pipelines than natural gas, due to the potential for embrittlement, leading to higher labor and material costs for hydrogen transmission.[190]

While pipelines are a cost-effective method for transporting hydrogen at high volumes (i.e., over 150 metric tons per day), initial capital costs for development are high. Estimated costs vary based on the size and location of the pipeline, but research on hydrogen pipelines estimates capital costs of approximately $1 million to $3 million per mile, depending on diameter.[191, 192] While the capital cost increases with diameter, the increased volume offsets the increased costs, so that the average cost per kilogram tends to decrease for larger diameter pipelines.[193]

However, while hydrogen pipelines have higher material and labor costs than their natural gas equivalents, capital costs for compression stations located along hydrogen pipelines are generally lower. As gases flow through the pipeline, they require additional compression to counteract pressure drops, which occur more quickly for natural gas than for hydrogen.[194] As a result, the amount of compression required is higher in natural gas pipelines, contributing to an estimated $660,000 per mile versus $308,000 per mile for hydrogen pipelines.[195] Work by DeSantis et al. (2021) suggests that, when compression costs are taken into account, capital costs for hydrogen pipelines can be lower than that for natural gas, coming in at $1.38 million per mile versus $1.69 million per mile for natural gas (assuming 36" pipeline).[196]

It is also important to consider that the geographic location of the pipeline can impact the costs associated with pipeline development. The Brooklyn Union Gas Company and KeySpan Gas East Corporation, both subsidiaries of National Grid, filed their Leak Prone Pipe (LPP) Prioritization Report in March of 2022, in which they estimated average costs of $8.7 million per mile and $2.2 million per mile, respectively, to replace natural gas distribution pipelines.[197] Similar documents filed by Niagara Mohawk Power Corporation, another subsidiary of National Grid, give estimates of $1.3 million per mile,[198] which is more closely in line with estimates found in the literature. The difference in cost is likely a function of the location, as Brooklyn Union operates in densely populated areas within New York City, KeySpan operates in the suburbs of New York City, and Niagara Mohawk operates in less densely populated areas in Upstate New York.

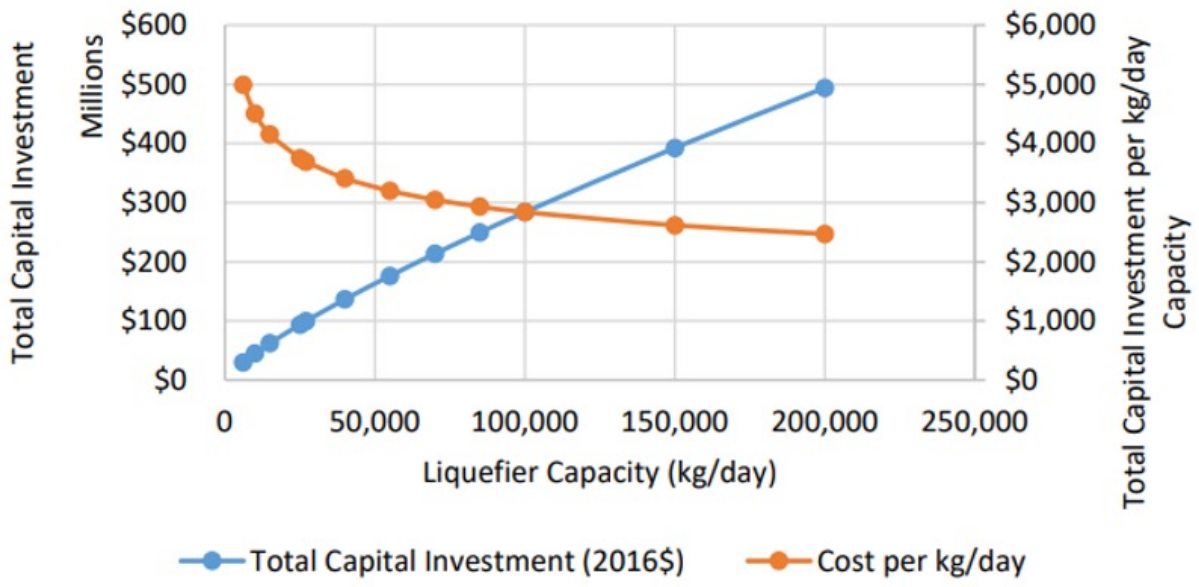
The primary alternative to pipeline transmission of hydrogen is transportation via trucks. Trucks can transport hydrogen in both liquid and gaseous forms, but truck delivery of liquid hydrogen is generally more cost-effective than that of gaseous hydrogen when transported over long distances (i.e., over 400 miles[199]) due in part to the increased energy density of liquid hydrogen. Other methods of transportation for hydrogen that could be investigated further for Connecticut's particular needs include rail and shipping on barges.

189 U.S. Department of Energy Hydrogen and Fuel Cell Technologies Office, Hydrogen Pipelines.
190 DeSantis, Daniel et al. (2021), Cost of long-distance energy transmission by different carriers.
191 Ibid.
192 Saadi, Fadl H. et al. (2018), Relative costs of transporting electrical and chemical energy.
193 DeSantis, Daniel et al. (2021), Cost of long-distance energy transmission by different carriers.
194 *Ibid*.
195 *Ibid*.
196 *Ibid*.
197 National Grid. "Annual Leak Prone Pipe (LPP) Prioritization, Type 3 Leak, and Capital Report." Case 19-G 0309 – Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of The Brooklyn Union Gas Company d/b/a National Grid NY for Gas Service and Case 19-G-0310 – Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of KeySpan Gas East Corporation d/b/a National Grid for Gas Service, 30 March 2022.
198 National Grid. "Annual LPP Prioritization, Type 3 Leak, and Capital Plan Report." Case 20-G-0381 – Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Niagara Mohawk Power Corporation d/b/a National Grid for Gas Service, 30 March 2022.
199 Connelly, Elizabeth et al., Department of Energy (2019), Current Status of Hydrogen Liquefaction Costs.

Shipping hydrogen over very long distances (e.g., between countries) typically requires conversion to a hydrogen carrier, such as Liquid Organic Hydrogen Carriers (LOHC) or ammonia. Ammonia is particularly promising as a hydrogen carrier because it is easier to store and transport than hydrogen, has a relatively high density, and already has widespread global infrastructure.[200] However, there are additional costs and facilities required to convert hydrogen to and from carriers, some of which involve significant process emissions.[201] These alternative transport methods require additional research and evaluation to determine their cost-effectiveness and suitability.

Although LOHCs and ammonia could be used for regional truck transport of hydrogen as well, this report assumes liquid hydrogen to be the primary method of increasing hydrogen energy density for long-distance truck delivery given its greater commercial use today. Research on the costs of hydrogen liquefaction suggests that capacities of 6,000 to 200,000 kilograms per day could be technically feasible, and the associated range of capital investment would be $30 million to $490 million.[202] For context, a typical commercial liquefier currently operates at a capacity of around 27,000 kilograms per day and has a capital contribution of about $1.40 per kilogram to the levelized cost of hydrogen, not including operating costs of electricity.[203] Liquefiers benefit from economies of scale, as the capital investment per kilogram of hydrogen decreases with higher volumes of throughput. However, these reductions are steepest at lower capacities (see Figure 15).

**FIGURE 15. CAPITAL INVESTMENT FOR LIQUEFIERS AT DIFFERENT CAPACITIES**




**Source:** DOE: Current Status of Hydrogen Liquefaction Costs (August 6, 2019)

200 Argus Media (2020), Green shift to create 1 billion tonne 'green ammonia market?

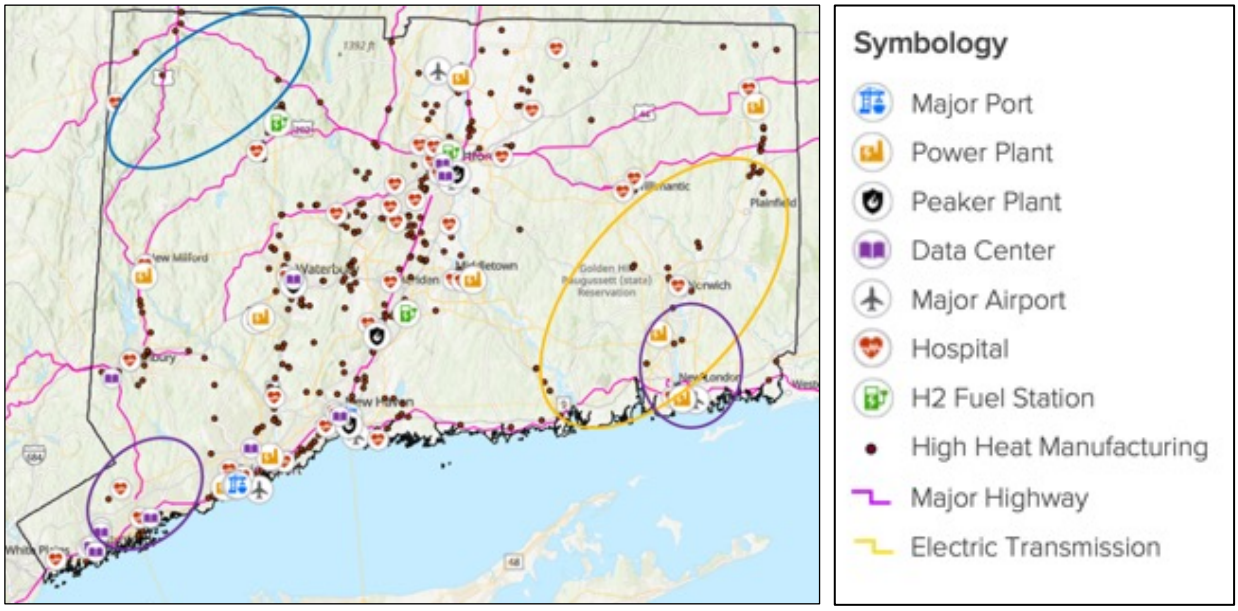
201 IRENA (2022), Global Hydrogen Trade to Meet the 1.5C Climate Goal: Technology Review of Hydrogen Carriers.

202 *Ibid.*

203 *Ibid.*

Based on the likely locations of hydrogen production and use in Connecticut, investment in hydrogen infrastructure is necessary to connect clean hydrogen production sources with end uses at scale. The map below shows the relative locations of major potential hydrogen offtakers compared to the most promising renewable energy production sites. The blue circle indicates areas with the highest onshore wind production capacity, while the orange circle marks areas with substantial solar production capacity. The purple circles represent areas where offshore wind could be interconnected with Connecticut in the future, although it's possible that interconnection limitations will require "virtual" connections between electrolyzers and offshore wind installations via PPA agreements.

**FIGURE 16: LOCATIONS OF HYDROGEN OFFTAKERS AND RENEWABLE ENERGY POTENTIAL IN CONNECTICUT**




**Source:** Strategen Consulting

### 4.2.2.2 | Recommendations

Based on the probable locations for hydrogen production and consumption in Connecticut, it's likely that additional infrastructure will be required to transport, store, and distribute hydrogen across the state. The following recommendations provide some steps that Connecticut could take to enable the development of this infrastructure:

+ **DEEP should lead interstate and interagency coordination to develop a hydrogen roadmap and strategy that identifies hydrogen supply and demand scenarios; approaches to a clean hydrogen backbone to enable cost-effective scaled transport; and other research and infrastructure investment opportunities to inform policy development and funding and RD&D strategy, in consultation with ecosystem stakeholders.** Connecticut can look to the DOE's National Clean Hydrogen Strategy and Roadmap[204] as a guide, and then use a similar or adapted methodology at the state level. Similarly, Connecticut can consider state reports, like the Oregon Department of Energy's renewable hydrogen report that seeks to identify where renewable hydrogen can be most useful in its decarbonizing economy.[205] In addition, existing hydrogen infrastructure should be studied to determine the value of refurbishing or completing partially installed or non-functional assets compared to installing new dedicated infrastructure. Connecticut's vision can build on work done and input provided to the Task Force, and ideally would include an examination of the following factors:

204 United States Department of Energy (2022), DOE National Clean Hydrogen Strategy and Roadmap.
205 Oregon Department of Energy (2022), Renewable Hydrogen In Oregon: Opportunities And Challenges.

- Current technologies available for hydrogen transport;
- The role of hydrogen transport costs in overall delivered cost;
- Cost and funding mechanisms for any enabling infrastructure and clean hydrogen production;
- Alignment with state policies and goals;
- Alignment with regional hub activities; and
- Stakeholder feedback, and especially community preferences.

+ **DEEP should investigate the need for hydrogen fueling stations to support multi-sectoral mobility applications, and as appropriate, coordinate with The Connecticut Department of Transportation to develop more specific strategies for optimizing siting and funding.** This could include an assessment of major transit routes to determine refueling locations that would best serve regional transit needs.
+ **DEEP should clarify and work with relevant agencies and stakeholders to explore the acceleration of permitting for clean hydrogen infrastructure, while ensuring appropriate guardrails to avoid unintended adverse impacts.** To scale development at the speed needed to transition to a clean economy, it is important to ensure that permitting requirements are transparent and readily understood by all stakeholders. An example of work that supports this goal is the Governor's Office of Business and Economic Development in California, which published the Hydrogen Station Permitting Guidebook with the explicit goal of streamlining the permitting process.[206] In addition to permitting, statutory authorization to build infrastructure, including that of LDCs, should be addressed to ensure coordinated and regulated build-out.

#### 4.2.2.3 | Stakeholder Feedback

Stakeholders have highlighted the need for hydrogen transportation and storage infrastructure although there is not consensus regarding the type of infrastructure that will be needed. FuelCell Energy noted that to scale the hydrogen supply and demand sectors, both distributed hydrogen and hydrogen pipeline transport will be needed.[207] PURA encouraged the consideration of which distribution technologies will be most beneficial to end users and the state. PURA noted that given the wide variety of potential end uses, they are not yet convinced that natural gas pipelines are the optimal option, as existing pipelines may not reach all potential end-use sites or serve all necessary end uses.[208]

Eversource stated that Connecticut should consider all forms of infrastructure, starting with pipelines, and understanding (and planning for) the roles of other delivery systems. They noted that the state should not prioritize certain infrastructure unless and until market signals clearly indicate that the infrastructure is needed and not otherwise being developed.[209] The Environmental Advocates stated that Connecticut should not invest in infrastructure to distribute hydrogen to buildings through the gas distribution system and any build out of infrastructure should focus on deployment of clean hydrogen for hard-to-decarbonize applications that cannot easily or cost-effectively be electrified.[210]

Regarding statutory authority, PURA explained that if existing natural gas distribution or transmission infrastructure is used to transport hydrogen, it will be subject to state and federal safety regulations and requirements overseen by PURA. They noted that these regulations mandate that LDCs maintain gas lines up to and including the gas meter while maintenance beyond the gas meter, i.e., the gas line that extends from the meter into a building, is normally the responsibility of the gas user or property owner. PURA acknowledged that current requirements are designed to accommodate the chemical properties of natural gas and may need to be modified to account for hydrogen.[211]

206 California Governor's Office of Business and Economic Development (2020), Hydrogen Station Permitting Guidebook.
207 FuelCell Energy Inc. (2022), Comments to Hydrogen Task Force, p. 5.
208 PURA (2022), Comments to Hydrogen Task Force, p. 2.
209 Eversource (2022), Comments to Hydrogen Task Force, p. 7.
210 Environmental Advocates (2022), Comments to Hydrogen Task Force, p. 12.
211 PURA (2022), Comments to the Hydrogen Task Force, p. 4.

Several parties also discussed the topic of safety associated with hydrogen transportation. The Environmental Advocates noted that best practices for the production, transport, delivery, storage, and use of clean hydrogen are still in development. They explained that the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) has recognized that there are major research gaps for safely using existing pipelines for potential hydrogen transport. Given the safety concerns associated with hydrogen transport and use, following best practices and establishing stringent regulatory requirements will be critical to minimize the chances of explosions and other risks. The Environmental Advocates recommended that safety requirements should be established and regularly updated in accordance with the best available science and regulators should provide a robust public engagement process to ensure that community concerns are taken into account.[212]

Bloom Energy noted that, with any gas, safety is always a concern, but modern engineering principles, material design, building codes, and safety trainings can mitigate much of the concern hydrogen presents, just as society has adapted to the inherent risks of more commonly used fuels such as natural gas, propane, gasoline, and diesel. They explained that codes organizations such as the National Fire Protection Association (NFPA), American Society of Mechanical Engineers (ASME), and American Society of Testing Materials (ASTM) already have regulations regarding hydrogen operations and should be looked to as technical resources for safe implementation and through a variety of efforts at National Labs, DOE also is providing substantial scientific research to support community and climate goals in the hydrogen sector.[213]

Eversource also pointed out that outside industry groups such as the American Institute of Chemical Engineers also have detailed knowledge on hydrogen systems and could be leveraged to provide additional input on safety topics. Eversource recognized that operational and safety concerns around blending will require the appropriate scientific inquiry that pipeline and local distribution companies are best positioned to perform.[214] In addition, Eversource advocated for the recommendation of direct legislative support of appropriate state regulatory oversight for hydrogen.[215] They also suggested legislative support could be leveraged to aid the deployment of hydrogen infrastructure, as well as the production, sale, and distribution of hydrogen.

The Environmental Advocates also raised concerns with the costs and inefficiencies associated with hydrogen infrastructure.[216] PURA noted their concern with rate-basing infrastructure to deliver hydrogen for purposes other than heat and power, which may not be the most beneficial, fair, or equitable option for ratepayers with gas service.[217] The Environmental Advocates noted, that while estimates may vary by distribution system, hydrogen cannot be blended into the gas distribution system at high volumes. They explained that in Connecticut, over 50% of gas mains are made of steel or iron, which cannot be used to transport a high level of hydrogen.[218] The Environmental Advocates stated that utilization of current natural gas infrastructure for hydrogen transport would not be sufficient and thus large capital investments in new infrastructure for hydrogen transport through pipelines would be necessary as well as large capital investments in hydrogen storage systems.[219] They also stated that truck or rail transport would also be expensive because hydrogen must be highly compressed, making these options realistic only for smaller volumes of hydrogen.[220]

212 Environmental Advocates (2022), Comments to the Hydrogen Task Force, p. 11.
213 Bloom Energy (2022), Comments to the Hydrogen Task Force, p. 3.
214 Eversource (2022), Comments to the Hydrogen Task Force, p. 6.
215 *Ibid*., p. 6.
216 Environmental Advocates (2022), Comments to the Hydrogen Task Force, p. 2.
217 PURA (2022), Comments to the Hydrogen Task Force, p. 2-3.
218 Environmental Advocates (2022), Comments to the Hydrogen Task Force, p. 12.
219 *Ibid*., p. 2.
220 *Ibid*., p. 12.

Stakeholders provided several recommendations for activities that may be needed regarding hydrogen infrastructure. Eversource advocated for the recommendation of direct legislative support for deployment of hydrogen infrastructure in Connecticut.[221] FuelCell Energy stated that Connecticut should work with neighboring states and the federal government on codes and standards for pipelines and other infrastructure, thus speeding up permitting for pipeline and vehicle fueling infrastructure. They also noted that for pipeline and fueling infrastructure, a Siting Council type approach that expedites approval while attending to energy justice concerns should be considered.[222] The Environmental Advocates noted that policies that will accelerate a transition to clean trucks, most notably California's Advanced Clean Trucks rule, will be critical to speed up the adoption of both electric and hydrogen fuel cell trucks in Connecticut. They recommended that Connecticut should coordinate with neighboring states and others in the region on developing the infrastructure needed to accommodate increasing numbers of electric trucks and hydrogen fuel cell trucks.[223]

### 4.2.3 | An identification of strategies for community engagement, outreach, and education related to hydrogen.

#### 4.2.3.1 | Findings

The Task Force found that clean hydrogen can provide an important tool to address economy-wide deep decarbonization and to address many issues related to energy equity, energy justice, and enabling a just and sustainable clean energy transition. As a low or zero-carbon fuel, hydrogen can help to reduce reliance on existing fossil fuel end uses that contribute to both global pollutants such as greenhouse gases, as well as local pollutants such as $NO_X$, $SO_2$, and $PM_{2.5}$ that increase adverse health impacts, up to and including premature death.

Notably, as the topic of hydrogen development advances, stakeholder concerns have been growing in response to topics that include hydrogen safety, infrastructure, workforce impacts, public health impacts, greenhouse gas emissions, and end use prioritization. As the clean hydrogen economy develops, it is critical to ensure that resultant benefits are equitably distributed and stakeholder concerns are addressed.

Further, the Biden Administration's Justice40 Initiative requires that 40 percent of the overall benefits of certain Federal investments be allocated to marginalized communities that are underserved and overburdened by pollution, and in many cases has placed increased focus on direct engagement and participation from these communities in the infrastructure planning and deployment process. Thus, it will be critical for Connecticut to prioritize community engagement, outreach, and education as it pursues hydrogen-related federal funding opportunities.

Effective community engagement aims to actively involve the community to achieve more cohesive long-term sustainable outcomes, processes, relationships, discourse, decision-making, and implementation. These efforts must be inclusive and intentional to build long-term relationships and develop meaningful solutions to complex issues. The activities of the Task Force have provided a starting point for community engagement with local experts including the Bridgeport Regional Energy Partnership, but these conversations will need to continue to ensure that the perspectives of all stakeholders are considered, and the public is educated and aware of hydrogen activity in the state.

221 Eversource (2022), Comments to the Hydrogen Task Force, p. 6.
222 FuelCell Energy Inc. (2022), Comments to the Hydrogen Task Force, p. 5.
223 Environmental Advocates (2022), Written Comments to the Hydrogen Task Force, p. 12.

#### 4.2.3.2 | Recommendations

The following recommendations will enable the state to increase community engagement and education related to hydrogen.

+ **The Legislature should create a transparent source for municipalities, cities, and other local applicants to access resources, such as match funding and/or application guidance.** This is being undertaken in other states to streamline the process of identifying match funding and project partners. For example, Colorado has established a Local Match Program, which allocates $80 million in state General Funds for the non-federal match requirements in the IIJA.[224] California passed a state law, SB 1075, which established a California Clean Hydrogen Hub Fund within the State Treasury that could authorize funding upon appropriation to be utilized to match federal funds.[225]
+ **The Legislature should provide funding to increase community engagement and decrease the burden of engagement on communities.** While community benefit agreements and Justice40 requirements are important steps in creating a more inclusive and equitable energy transition, they will require considerable time and resources from local stakeholders to engage effectively. The state can further demonstrate its support for communities by providing funding for time and resources, such as technical expertise and consulting services to develop community benefits agreements.
+ **DEEP should solicit feedback and guidance from the Connecticut Equity and Environmental Justice Advisory Council (CEEJAC) to advance community impact, environmental justice, and energy equity discussions on hydrogen and to support the development of a framework that outlines both a vision and goals for Connecticut's clean hydrogen policies.** In California, community impacts have been taken into account through the creation of advisory boards and other programs through state agencies, including the California Air Resources Board (CARB).[226,227] Engaging the community – especially communities that are disadvantaged – is a critical step in ensuring the transition to a clean economy is one that is as inclusive, just, and sustainable as possible.

#### 4.2.3.3 | Stakeholder Feedback

Many stakeholders emphasized the importance of community outreach and education. FuelCell Energy emphasized that Connecticut is fortunate to have a significant representation of the nascent clean hydrogen industry in-state already, and some facilities like FuelCell Energy's Torrington manufacturing operations, are in DECD distressed communities.[228] They acknowledged that as these companies expand and as new companies enter the market, Connecticut should continue robust economic development outreach to attract these companies to the state and to environmental justice and distressed communities. Both FuelCell Energy and Bloom Energy encouraged building a foundation of clear scientific education for the public as well as developing and establishing transparent project development processes directly involving local communities.[229]

Bloom Energy and CCAT noted that understanding community needs will require robust, direct engagement with impacted communities.[230] Eversource also identified that forums such as those used in developing the Comprehensive Energy Strategy and Integrated Resource Plan provide valuable opportunities for stakeholder participation.[231]

224 Colorado Department of Local Affairs, Local Match Program.
225 California Legislature (2022), Senate Bill 1075.
226 California Air Resources Board, Environmental Justice Advisory Committee.
227 California Public Utilities Commission, Disadvantaged Communities Advisory Group.
228 FuelCell Energy Inc. (2022), Written Comments to the Hydrogen Task Force, p. 3.
229 FuelCell Energy Inc. (2022), Comments to the Hydrogen Task Force, p. 3 and Bloom Energy (2022), Comments to the Hydrogen Task Force, p. 2.
230 Bloom Energy (2022), Comments to the Hydrogen Task Force, p. 2 and CCAT (2022), Comments to the Hydrogen Task Force, p. 4.
231 Eversource (2022), Comments to the Hydrogen Task Force, p. 5.

Stakeholders had robust recommendations regarding community outreach planning, defining community impacts, and public education. FuelCell Energy recommended that Connecticut should create a task force that works with developers to define, communicate, and mitigate local impacts in partnership with environmental justice and disadvantaged communities. They also recommended that Connecticut could prioritize, through a variety of incentives, projects that displace legacy systems that have negative local impacts with clean hydrogen alternatives. FuelCell Energy also noted that Connecticut should also work with the federal government to ensure alignment with federal and state definitions of distressed communities as not all DECD distressed communities are recognized in the DOE's Justice40 model as Disadvantaged Communities. They also highlighted that stringent standards on air pollution would incentivize the development of truly clean hydrogen production. Eversource noted that the strong, existing relationships that local distribution companies have with environmental justice and disadvantaged communities should be leveraged.[233]

The Environmental Advocates stated that Connecticut should develop an outreach plan to educate the public about the state's clean hydrogen planning and development process. As a starting point, state officials should reach out to regional councils of government, municipal officials, Energy Task Force members and the CT Energy Network, environmental and environmental justice groups, business and/or industry associations and groups, and community groups. They noted that as a first step, the Connecticut Equity and Environmental Justice Advisory Council (CEEJAC) should be consulted and should participate in creating equity and EJ-focused components of the state's hydrogen outreach plan.

The Environmental Advocates explained that for any hydrogen siting decisions that may impact EJ or disadvantaged communities, early and meaningful stakeholder engagement will be critical, as will consideration of cumulative impacts. They recommended that state and local siting authorities and project proponents should make it a priority to identify and engage with potentially affected communities early in the siting process, while there is still an opportunity for local residents to influence the location and suggest measures, such as community benefits agreements, to mitigate any negative impacts associated with the hydrogen project. They also highlighted that best practices in public outreach should be utilized, such as meeting communities where they are (e.g. by holding local meetings at places of worship, schools, community centers, etc.), holding meetings on the weekend or during evenings when more working people can attend, providing outreach materials in accessible languages spoken in the community, providing options for in-person and remote meetings, recording and transcribing meetings for later viewing online, and providing free food, childcare, and compensation for people who participate in community meetings.[234]

233 Eversource (2022), Comments to the Hydrogen Task Force, p. 2.
234 Environmental Advocates (2022), Comments to the Hydrogen Task Force, p. 11.

# 5 | Conclusion

Connecticut is well positioned to capitalize on hydrogen-related federal funding opportunities given its many competitive strengths, including its participation in the Northeast Regional Hub application effort, its strategic positioning along high-volume transit corridors, its presence of a robust and nation-leading fuel cell and electrolyzer industry, and its existing efforts to support community engagement, particularly within disadvantaged communities. However, given federal match funding requirements and the imminent timing of funding applications, Connecticut must urgently consider its resources and funding strategy if the state wishes to capture significant federal funding.

At the direction of the Connecticut Legislature, the Task Force developed findings and recommendations based on in-depth analyses and research, expert input, and stakeholder feedback to establish the opportunity for a clean hydrogen economy in Connecticut. The Task Force also identified actions required to enable an equitable and just clean energy transition that includes clean hydrogen.

Additionally, the Connecticut Green Bank would like to thank the Energy and Technology Committee for the opportunity to convene the Task Force to study hydrogen-fueled energy in Connecticut's economy and energy infrastructure. We would also like to thank the Task Force members, designees, and participants who contributed their time and resources to a robust study of hydrogen and its potential impact on Connecticut as reflected in this report. The Connecticut Green Bank looks forward to supporting the future processes and actions that are initiated within the state based on the findings and recommendations presented by the Task Force.

# Appendix A: Hydrogen End Uses Evaluation

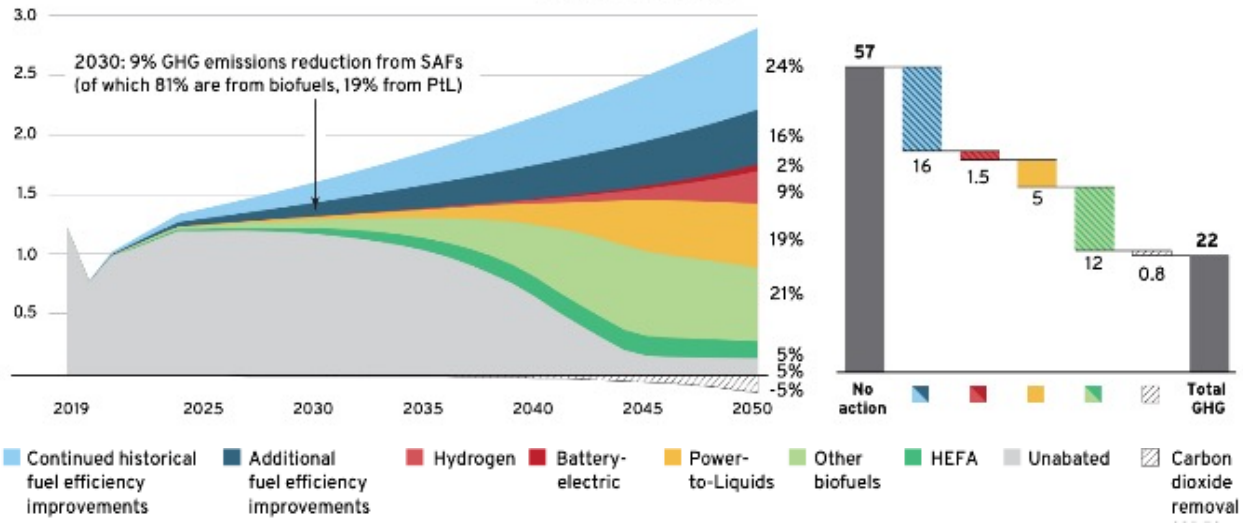
Appendix A provides a discussion of the methodology and sources utilized by Strategen to evaluate the prioritization of hydrogen end uses. The end uses discussed in this section include aviation, maritime shipping, industrial heat, residential and commercial heat, the power sector, heavy-duty vehicles, buses, passenger cars, material handling equipment, ferries, critical facilities, rail, and hydrogen blending. A systems level analysis of hydrogen use is also discussed.

## A.1. | Aviation

The aviation industry is responsible for emitting 1.24 gigatons of CO2e every year, equivalent to 2% of the global anthropogenic GHG emissions and 3.5% of the overall climate impact, due to net effective radiative forcing. By 2050, this impact could potentially double or triple in the absence of meaningful policy and technology deployment advances (Mission Possible Partnership 2022). The aviation industry currently relies on jet fuel, a heavy-oil fuel that is refined from crude oil nationwide. Depending on the size of the airport, jet fuel is typically delivered by truck or through direct pipelines.

In 2022, the Mission Impossible Partnership (MPP) assessed two potential pathways to decarbonize aviation: a prudent and an optimistic scenario. Both pathways analyzed by MMP project a mix of incremental efficiency gains, biofuels, hydrogen, and batteries as potential alternatives to current jet fuels but assume different market shares and timing for these alternatives depending on the speed of renewable electricity cost reductions.

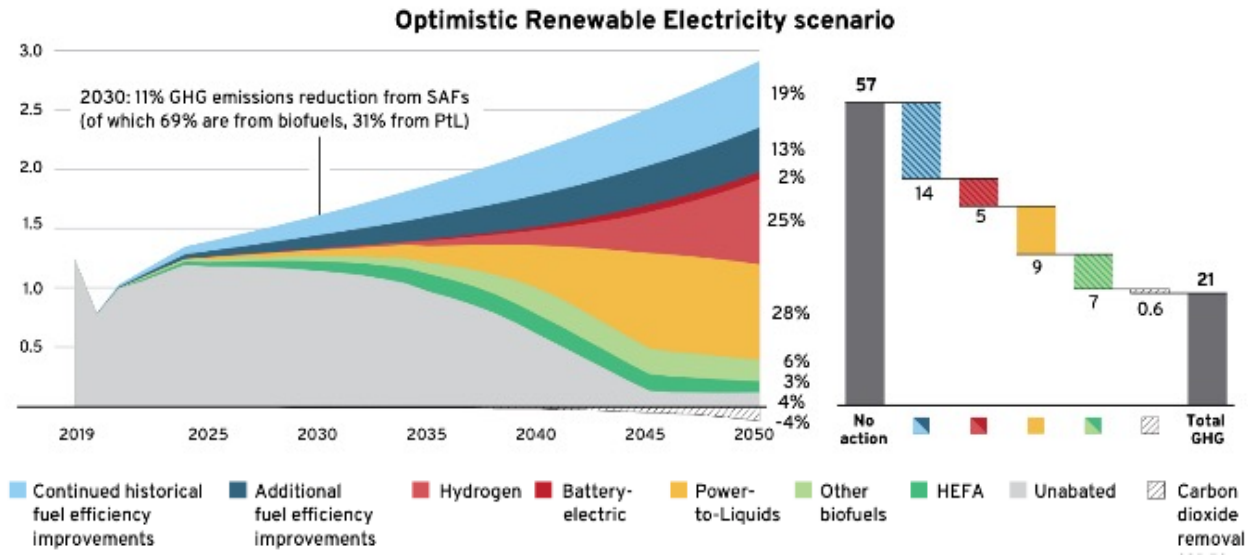
**FIGURE 17. PRUDENT DEPLOYMENT SCENARIO FOR THE AVIATION SECTOR**




**Source:** Mission Possible Partnership. "Making Net-Zero Aviation Possible. An industry-backed, 1.5°C-aligned transition strategy." July 2022.

In the prudent scenario, the assumed cost of renewable electricity does not allow for scaled, economic deployment of clean hydrogen and derivative fuels until the 2040s. Hence, biofuels are identified as the most promising alternative to decarbonize aviation in this scenario. In the optimistic scenario, the cost of renewable electricity declines at a rate that allows hydrogen to be cost competitive by 2030 and to scale up over the following decade. However, even in the prudent scenario, hydrogen and hydrogen-derived fuels demonstrate the fastest gains in market share post-2045, indicating that these hydrogen fuels will ultimately be the most cost-effective for sectoral decarbonization over the long term compared to other potential solutions (Mission Possible Partnership 2022).

## FIGURE 18. OPTIMISTIC DEPLOYMENT SCENARIO FOR THE AVIATION SECTOR




*NOTE: Sums in contributions to 2050 GHG emissions may not total 100 due to rounding*

**Source:** Mission Possible Partnership. "Making Net-Zero Aviation Possible. An industry-backed, 1.5°C-aligned transition strategy." July 2022.

Biofuels are the only sustainable aviation fuel (SAF) available today and are expected to represent the majority of the aviation fuel market in 2050 if costs for hydrogen remain high. However, biofuel use will also depend on whether sufficient volumes of sustainable biomass, which is subject to global resource constraints, can be directed to the aviation sector. Hydrogen Power to Liquid (PtL) fuels are projected to enter the market in the late 2020s and are expected to decline in cost by the mid-2030s. In future scenarios where low electricity costs push down the cost of clean hydrogen production, PtL fuels are likely to outcompete biofuels sooner than would otherwise be the case (Mission Possible Partnership 2022).

Hydrogen and battery electric aircraft will require further investments in technology development and production. Aircraft powered directly by hydrogen fuel cells could become commercially available in the 2030s and scale up through 2050 to reach as much as a third of aviation's final energy demand. Without substantial changes to aircraft design, however, the range of these aircraft could be limited to about 2,500 km due to the additional space requirements for storing hydrogen onboard. If new airframe designs and storage technologies are developed, these advances could increase the range of hydrogen fuel cell aircraft and allow them to further increase their market share (Mission Possible Partnership 2022). Battery-electric aircraft would likely require breakthroughs in battery chemistry, but even with such advances, battery-electric aircraft likely could only power regional flights up to about 1,000 km by mid-century. Designated "green corridors" could support deployment of both hydrogen and battery-electric aircraft by providing refueling or recharging infrastructure at dedicated airports that are connected by regular flight routes (Mission Possible Partnership 2022).

A study by the Clean Air Task Force (CATF) reached a similar conclusion to that of the MPP study. Namely, that a combination of aviation biofuels, scalable zero-emission fuels, and low-carbon electricity is needed to displace conventional jet fuel. The CATF study has a focus on biofuels and highlights that ramping up aviation biofuel production is a worrisome prospect given that bioenergy already faces several sustainability and supply chain challenges (Clean Air Task Force 2022).

### Supporting Research

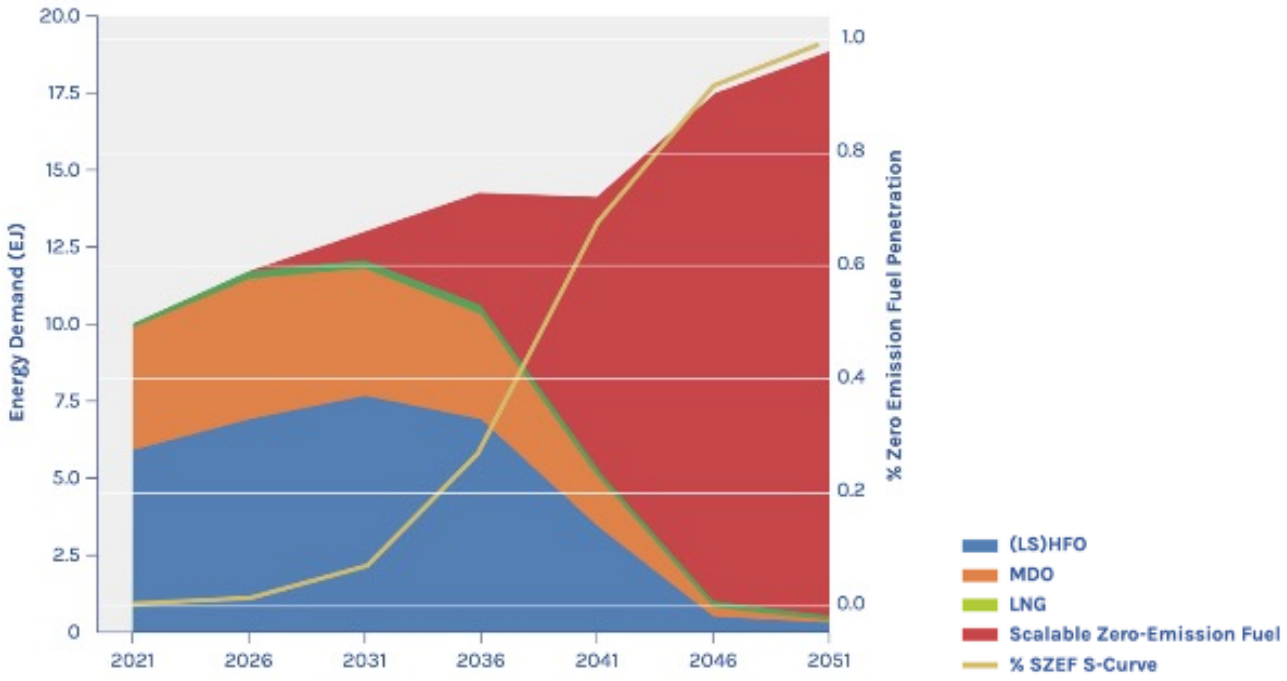

+ Clean Air Task Force. “Decarbonizing Aviation: challenges and opportunities for emerging fuels”. September 2022. https://cdn.catf.us/wp-content/uploads/2022/09/13101935/decarbonizing-aviation.pdf
+ Hudda, Neelakshi et al. “Impacts of Aviation Emissions on Near-Airport Residential Air Quality.” *Environmental Science & Technology*, vol. 54, no. 14, 8 July 2020, pp. 8580-8588. https://pubs.acs.org/doi/abs/10.1021/acs.est.0c01859
+ Liu, Zhu, et al. “Near-real-time and state-level monitoring of U.S. CO2 emissions.” *Carbon Monitor*, April 2022. Website. https://carbonmonitor.org/
+ Mission Possible Partnership. “*Making Net-Zero Aviation Possible. An industry-backed, 1.5°C-aligned transition strategy*.” July 2022. https://missionpossiblepartnership.org/wp-content/uploads/2022/07/Making-Net-Zero-Aviation-possible.pdf
+ National Bureau of Economic Research. “Airports, Air pollution and Health.” *The Digest*: no. 5, May 2012. https://www.nber.org/digest/may12/airports-air-pollution-and-health


## A.2. | Maritime Shipping

Currently, marine ships are fueled by bunker fuel, a generic name for different types of heavy fuel oil (HFO) with diverse quality classifications. HFO is the most common fuel for large ships because it is inexpensive and energy dense. As fuel represents 30-35% of total operating costs for the maritime shipping industry, the majority of the global shipping fleet relies on cheap diesel Bunker C fuel oil (a low-quality HFO) which contributes significant amounts of GHGs, sulfur, and other emissions that contribute to climate change and cause adverse environmental and human health impacts. In places where the emissions of ships are regulated, Marine Gas Oil (MGO, a low-sulfur fuel oil) is one of the most prominently used fuels.

In 2021, the G7 nations made a clear commitment to align international shipping with the goal to maintain global warming under 1.5°C degrees, a pathway that requires a 45% emission reduction from 2010 levels by 2030 and net-zero emissions by 2050. A report commissioned by the MPP in 2021 put forward a pathway to achieve this decarbonization goal within the maritime sector. The MPP analysis projected that liquified natural gas (LNG) use would expand out to 2030 but would still compose a relatively small share of the overall fuel mix. The MPP determined that the bulk of maritime decarbonization could be achieved by rapidly increasing the use of scalable zero-emission fuels (SZEFs), which will be introduced in 2026 and rapidly scaled up around 2031, according to the analysis. The MPP projected that the use of all other fossil fuels would decline rapidly as SZEFs enter the market (Mission Possible Partnership 2021).

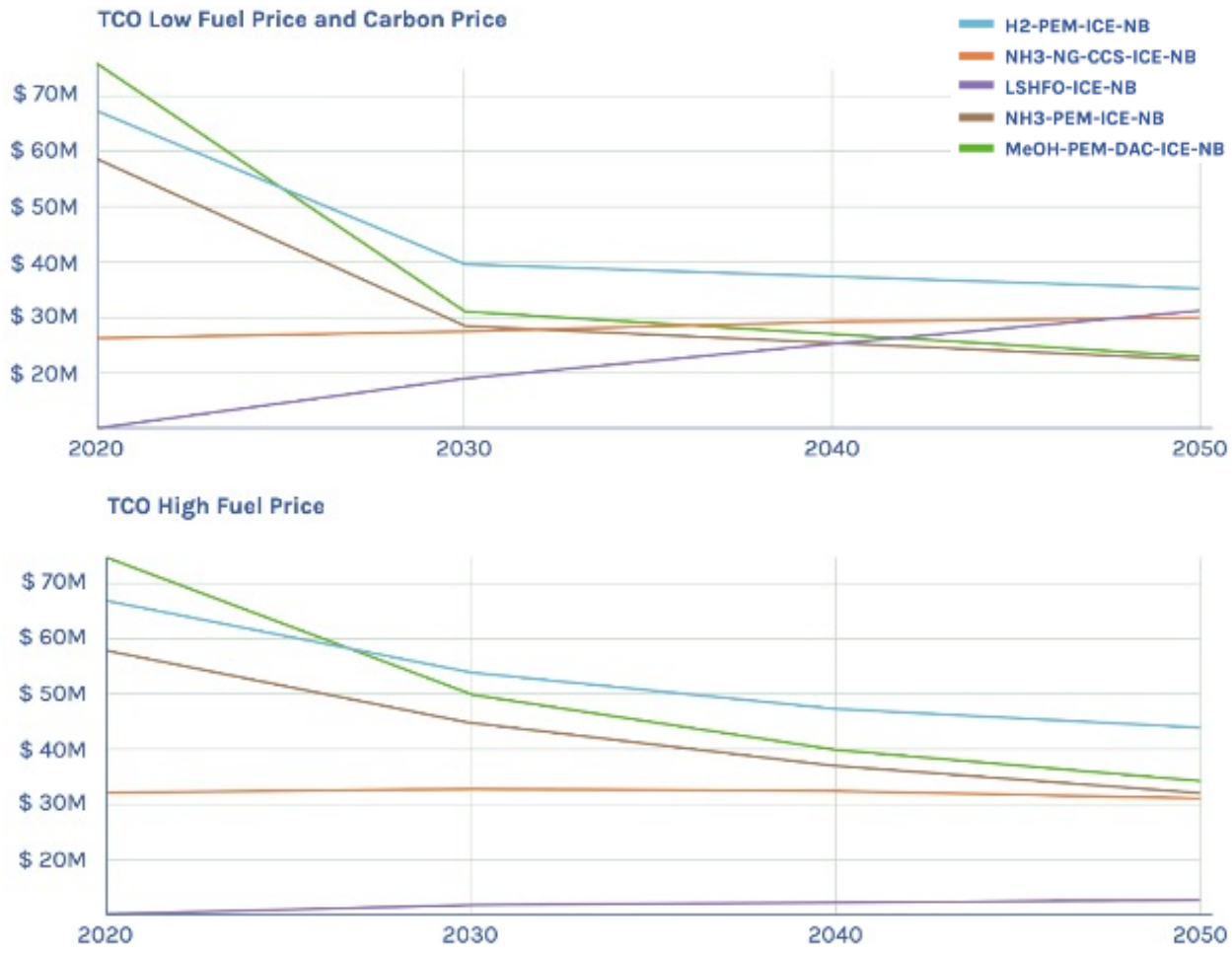
## FIGURE 19. PROJECTION OF MARITIME ENERGY MIX




**Source:** Mission Possible Partnership. "A Strategy for the Transition to Zero-Emission Shipping: An analysis of transition pathways, scenarios, and levers for change." 2021.

Multiple fuels are being considered as potential SZEFs for the maritime sector, namely biofuels and hydrogen-based fuels like ammonia and e-methanol. The MPP report portrays ammonia as the most cost-effective SZEF after 2030. The study assumes that given underlying supply constraints, growing demand for biomass-based fuels will increase their prices, but growing demand for hydrogen will help lower hydrogen and hydrogen-based fuel costs by driving economies of scale in production once potential supply chain bottlenecks are overcome (Mission Possible Partnership 2021).

## FIGURE 20. PROJECTION OF THE TOTAL COST OF OWNERSHIP OF DIFFERENT FUELS AND PRODUCTION PATHWAYS




**Source:** Mission Possible Partnership. "A Strategy for the Transition to Zero-Emission Shipping: An analysis of transition pathways, scenarios, and levers for change." 2021.

### Supporting Research

+ Connecticut Department of Energy and Environmental Protection. "*Development of a Strategic Plan for Reducing Emissions Associated with Freight Movement in Connecticut.*" 28 March 2013. https://portal.ct.gov/-/media/DEEP/air/mobile/2013---Connecticut-Freight-Report---Final-with-Appendices.pdf
+ McKinlay, Charles J. et al. "Route to zero emission shipping: Hydrogen, ammonia or methanol?" *International Journal of Hydrogen Energy*, vo. 46, no. 55, 10 August 2021, pp. 28282-28297. https://www.sciencedirect.com/science/article/abs/pii/S0360319921022 175?via%3Dihub
+ Mission Possible Partnership. "*A Strategy for the Transition to Zero-Emission Shipping: An analysis of transition pathways, scenarios, and levers for change.*" 2021. https://www.globalmaritimeforum.org/content/2021/10/A-Strategy-for-the-Transition-to-Zero-Emission-Shipping.pdf

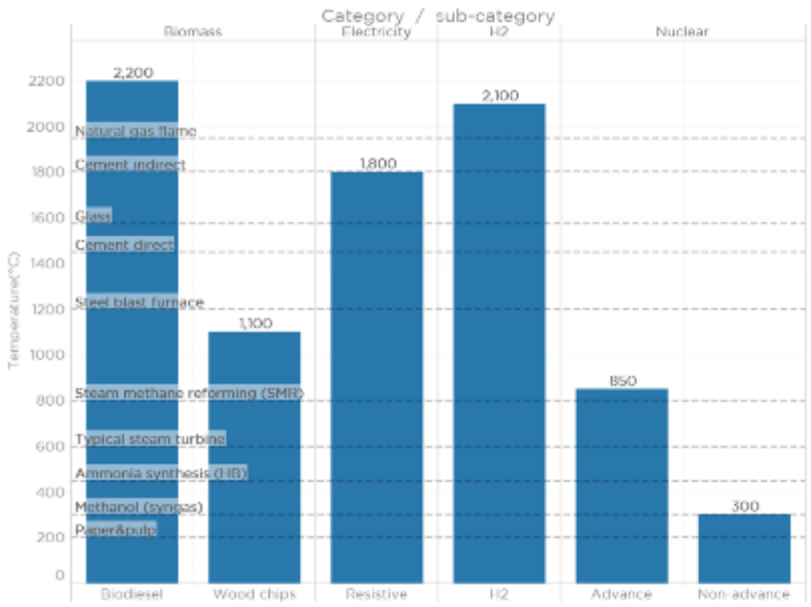
## A.3. | Industrial Heat

The United States industrial sector utilizes heat for an array of applications including washing, cooking, sterilizing, drying, and the generation of process heating. These processes occur at different scales and temperatures, and the viability of heating alternatives depends on these factors. Today, the majority of industrial process heat demand relies on the combustion of fossil fuels. Most low-temperature heating needs could be served by energy efficiency and renewable energy, but hydrogen and other zero-carbon fuels provide potential alternatives to decarbonize higher-temperature needs.

According to a study of industrial heating in European countries, 30% of industrial heating applications require heat below 100°C, another 27% can be met with heat between 100 and 400°C, and the remaining 43% require heat above 400°C (Vannoni 2008). Many renewable heating resources can easily meet lower temperature requirements (i.e., at or below 150°C), and even if renewable sources cannot support the entire heating load, they can still provide pre-heating to supplement a conventional heating process (U.S. Department of Energy 2022). As it takes a relatively large amount of energy to raise the temperature of water (compared with heating air, for example), even a modest amount of pre-heating can reduce a facility's dependence on fossil fuels while also reducing costs in the process.

However, many industrial processes require significant amounts of thermal energy at very high temperatures that exceed what can be economically provided by direct electrification. For example, conventional steel blast furnaces require temperatures of about 1,100°C, and cement kilns require about 1,400°C. In addition, many industrial facilities require continuous operation, or need to be able to be operated on demand (Friedmann 2019). Low-carbon fuels like hydrogen and biogas are economically viable solutions that exist today to reduce CO2 emissions at scale for high temperature industrial processes (see Figure 21).

### FIGURE 21. TEMPERATURE REQUIREMENT OF SELECTED INDUSTRIES AND TEMPERATURE OF LOW CARBON REPLACEMENT FUELS




**Source:** Friedmann, Julio, Zhiyuan Fan and Ke Tang. "Low-Carbon Heat Solutions for Heavy Industry: Sources, Options, and Costs Today." Columbia University, Center on Global Energy Policy, 7 October 2019.

The U.S. Department of Energy's "Industrial Decarbonization Roadmap" identifies four key technological pillars to significantly reduce emissions for the five subsectors studied (*Chemicals, Refining, Iron & Steel, Food & Beverages, and Cement & Lime*): energy efficiency; industrial electrification; low-carbon fuels, feedstocks, and energy sources (LCFFES); carbon capture, utilization, and storage (CCUS). Hydrogen, along with biofuels, falls under the "LCFFES" category and can provide a means to reduce combustion emissions for industrial processes with heat demands that are difficult to satisfy with electrified solutions (U.S. Department of Energy 2022).

**Supporting Research**


+ Friedmann, Julio, Zhiyuan Fan and Ke Tang. "*Low-Carbon Heat Solutions for Heavy Industry: Sources, Options, and Costs Today.*" Columbia University, Center on Global Energy Policy, 7 October 2019. https://www.energypolicy.columbia.edu/sites/default/files/file-uploads/LowCarbonHeat-CGEP_Report_111722.pdf
+ Hess, Stefan. "Solar thermal process heat (SPH) generation. Renewable heating and cooling." *Technologies and Applications*, 2019, pp. 41-66.
+ McMillan et al. "*Opportunities for Solar Industrial Process Heat in the United States.*" National Renewable Energy Laboratory, NREL/TP-6A20-77760, January 2021. https://www.nrel.gov/docs/fy21osti/77760.pdf
+ U.S. Department of Energy (DOE). "Industrial Decarbonization Roadmap." 2022. https://www.energy.gov/sites/default/files/2022-09/Industrial%20Decarbonization%20Roadmap.pdf
+ Vannoni, Claudia, Riccardo Battisti, and Serena Drigo. "*Potential for Solar Heat in Industrial Processes. Solar Heating and Cooling Program.*" International Energy Agency, 2008. https://archive.iea-shc.org/data/sites/1/publications/task33-Potential_for_Solar_Heat_in_Industrial_Processes.pdf


## A.4. | Residential/Commercial Heat

Hydrogen may be used to provide space heating for residential and commercial buildings, similar to the way natural gas provides heat to these buildings today. However, utilizing 100% hydrogen in the current natural gas distribution network, rather than low-level blends with natural gas, would require significant retrofits of the existing pipeline network, as well as upgrades to customer furnaces to effectively combust hydrogen for heat. A meta-analysis of 32 independent studies considering the use of hydrogen-based heating systems for residential customers found that hydrogen was more expensive than electrification regardless of the climate or region studied (Rosenow 2022).

A key reason for the relatively high cost of hydrogen-powered heating systems compared to heat pumps is the efficiency loss associated with hydrogen heating. Electrolyzers and hydrogen boilers can typically only convert electricity to heat at a total pathway efficiency of around 70%, whereas heat pumps can often achieve electricity-to-heat conversion efficiencies of 300% or higher (Baldino 2021). As a result, electrification pathways for space heat require significantly less build-out of renewable energy capacity than hydrogen-based pathways, with corresponding lower costs. The cost of renewable capacity build-out as well as the additional costs of retrofitting the gas distribution network for 100% hydrogen blends makes hydrogen use for residential and commercial heat unreasonable outside of niche applications.

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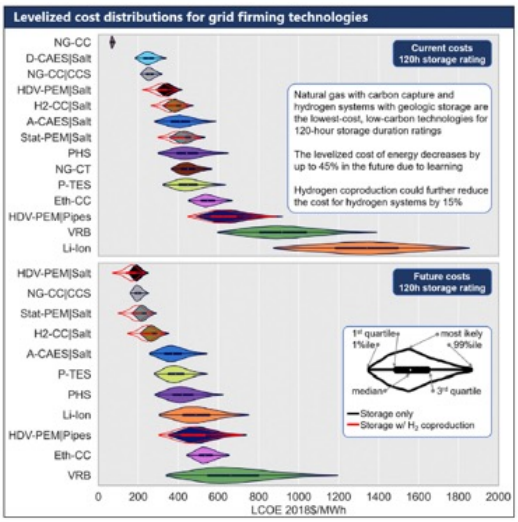
## A.5. | Power Sector

In the power sector hydrogen could be used as a carbon-free fuel in turbines and fuel cells, which could enable high penetration of renewables on the grid by providing dispatchability and long-duration storage capabilities. Notably, as renewables become cheaper, they will replace fossil fuel generation but will also create a need for flexibility (dispatchable energy) during low-renewable periods to manage seasonal fluctuations in the availability of renewable energy sources like wind or solar. Turbines capable of burning 100% hydrogen blends are in development today and could be commercially available by 2030 (Power Magazine 2019).

There are a number of potential technologies that could serve long-duration storage needs, including gas turbines with carbon capture and long-duration batteries like vanadium flow systems. However, the cost advantages of hydrogen, particularly when coupled with low-cost underground storage, make it one of the most economic options as electrolyzer costs fall over time. Figure 22 compares the projected costs of different technologies capable of providing 120 hours of grid storage, using learning curve assumptions to estimate both current and future costs (Hunter 2021). Based on expected cost declines, hydrogen used in both combustion turbines and fuel cells are expected to be the most economic long-duration storage option that doesn't require carbon capture.

### FIGURE 22. RELATIVE COSTS OF LONG-DURATION STORAGE TECHNOLOGIES



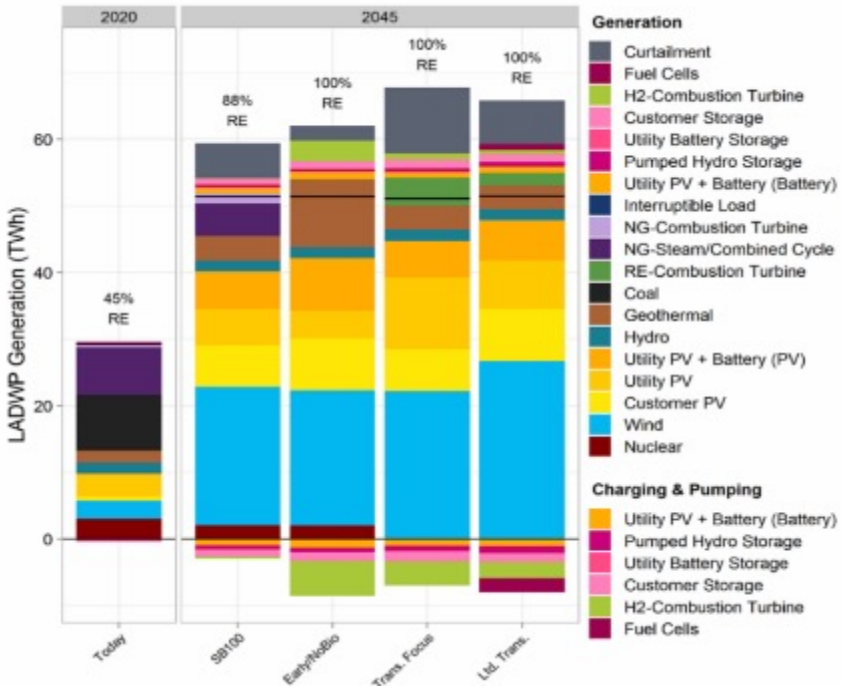

| Acronym | Technology description |
|---|---|
| PHS | pumped hydropower storage |
| D-CAES \| Salt | diabatic compressed air energy storage in a salt cavern that relies on natural gas combustion to reheat the air |
| A-CAES \| Salt | adiabatic compressed air energy storage in a salt cavern that relies on thermal energy storage to reheat the air |
| P-TES | pumped thermal energy storage |
| VRB | vanadium redox flow batteries |
| LI-Ion | lithium-ion batteries |
| NG-CT | natural gas combustion turbine |
| NG-CC | natural gas combined cycle |
| NG-CC \| CCS | natural gas combined cycle with 90% carbon capture and sequestration |
| Eth-CC | ethanol-fueled combined cycle |
| $H_2$-CC \| Salt | hydrogen production via PEM electrolysis, power generation via combined cycle, and hydrogen storage in a salt cavern |
| Stat-PEM \| Salt | hydrogen production via PEM electrolysis, power generation via a stationary PEM fuel cell, and hydrogen storage in a salt cavern |
| HDV-PEM \| Salt | hydrogen production via PEM electrolysis, power generation via heavy-duty vehicle fuel cells, and hydrogen storage in a salt cavern |
| HDV-PEM \| Pipes | hydrogen production via PEM electrolysis, power generation via heavy-duty vehicle fuel cells, and hydrogen storage in underground pipes |

**Source:** Hunter, Chad A. et al. "Techno-economic analysis of long-duration energy storage and flexible power generation technologies to support high-variable renewable energy grids." Joule, 5, 8, 2021.

Burning hydrogen in combustion turbines could be done by retrofitting existing turbines or using hydrogen-ready turbines, but risks of high NOx emissions need to be mitigated with specialized technology. The Clean Energy Group (CEG) has warned that burning hydrogen for power generation can produce dangerously high levels of nitrogen oxides (Milford 2021), however, research by the DOE has indicated that NOx from hydrogen combustion can be effectively controlled by technological or operational changes, leading to a conclusion that "hydrogen turbines of the future will have comparable performance and emissions of NOx compared to today's natural gas-fueled turbines" (U.S. Department of Energy 2022). It is, however, important that regulation shifts to ensure hydrogen-based turbines are held to the same emission standards as natural gas turbines.

In 2021, the Los Angeles Department of Water and Power (LADWP), in partnership with the National Renewable Energy Laboratory, conducted a detailed study of the resources needed to transition the Los Angeles power system to 100% renewable energy by 2045. The study results indicated that hydrogen for power generation, both in combustion turbines and (in some scenarios) in fuel cells, would be required to effectively balance a system with high renewable energy penetration (National Renewable Energy Laboratory 2021).

## FIGURE 23. RELATIVE COSTS OF LONG-DURATION STORAGE TECHNOLOGIES




**Source:** National Renewable Energy Laboratory. "LA100: The Los Angeles 100% Renewable Energy Study and Equity Strategies." March 2021.

In addition to being combusted in retrofitted gas turbines, hydrogen can also be used to generate clean power directly in fuel cells. This has both efficiency and air quality benefits, as fuel cells can have higher conversion efficiencies than gas turbines – particularly turbines that are not combined cycle models – and produce no NOx emissions. However, fuel cells of this size have limited commercial deployment and still face higher costs today, although these costs are expected to fall as fuel cell manufacturing picks up globally.

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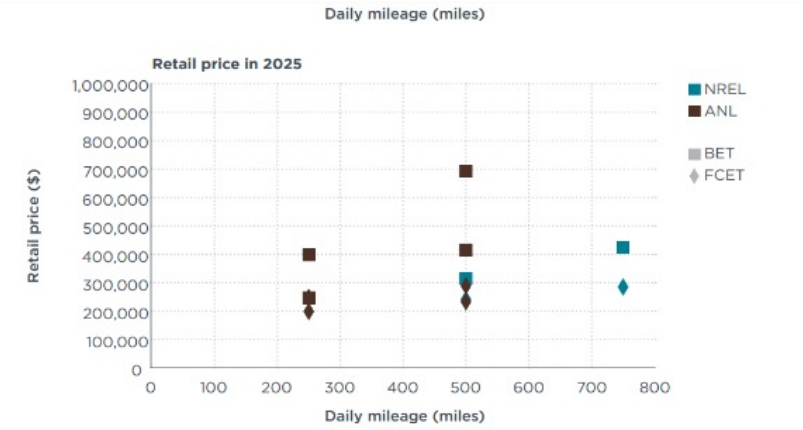
## A.6. | Heavy-Duty Vehicles

Heavy-duty vehicles are defined as any truck over 26,000 lbs. which includes both class 7 and 8 US gross vehicle weight rating (GVWR) truck classifications. Due to their irregular scheduling, low downtimes, heavy loads, and long distances of travel, hydrogen is a promising decarbonization solution for heavy-duty vehicles.

The International Council on Clean Transportation estimated that upfront costs for battery-electric and hydrogen fuel cell tractor trucks can vary by up to a factor of four. Battery-electric truck (BET) up-front costs range from about $200,000 to $800,000, with fuel cell electric trucks (FCET) in the same studies ranging from $200,000 to $600,000. Capital costs are a function of total battery capacity and increase with increased range. Currently, electric propulsion systems for zero-emission tractor trucks make up upwards of 90% of total truck costs, but according to the ICCT, this value is expected to fall to as low as 75% in the next decade due to an expected decrease in battery pack and fuel cell systems costs (Sharpe and Basma 2022).

Figure 24 illustrates the relative costs of battery electric trucks and fuel cell trucks in 2025, as forecasted by Argonne National Laboratory (ANL), and the National Renewable Energy Laboratory (NREL). This graph highlights that the price of battery electric trucks is a function of expected daily mileage, due to increasing costs associated with larger battery capacity. As a result, within both the NREL and ANL analysis, the retail price gap between fuel cell and battery electric trucks increases as daily mileage increases. ANL's analysis considered both Class 8 day cabs, as well as Class 8 sleeper cabs. For daily mileage values with two reported prices for the same technology type, the higher value represents the sleeper cab variation (Sharpe and Basma 2022).

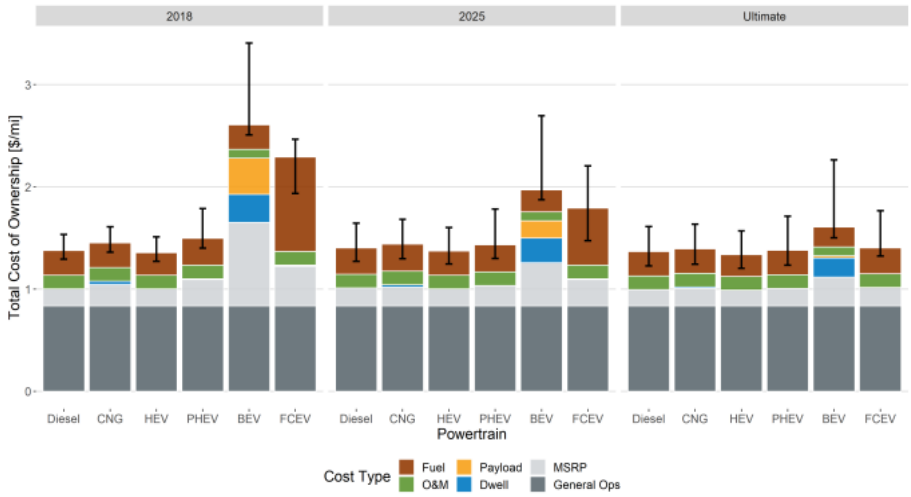
## FIGURE 24. COMPARATIVE COSTS OF BATTERY ELECTRIC TRUCKS AND FUEL CELL TRUCKS, 2025




**Source:** Sharpe, Ben and Hussein Basma. "A meta-study of purchase costs for zero emission trucks (Working Paper 2022-09)." International Council on Clean Transportation, February 2022.

NREL's Spatial and Temporal Analysis of the Total Cost of Ownership for Class 8 Tractors and Class 4 Parcel Delivery Trucks provides a total cost of ownership analysis beyond procurement costs. This report includes dwell and payload costs which cause fuel cell electric vehicles (FCEVs) to reach cost parity with battery electric vehicles (BEVs) much sooner due to the additional costs related to BEV trucks' higher weights and longer charging times (Hunter et al. 2021).

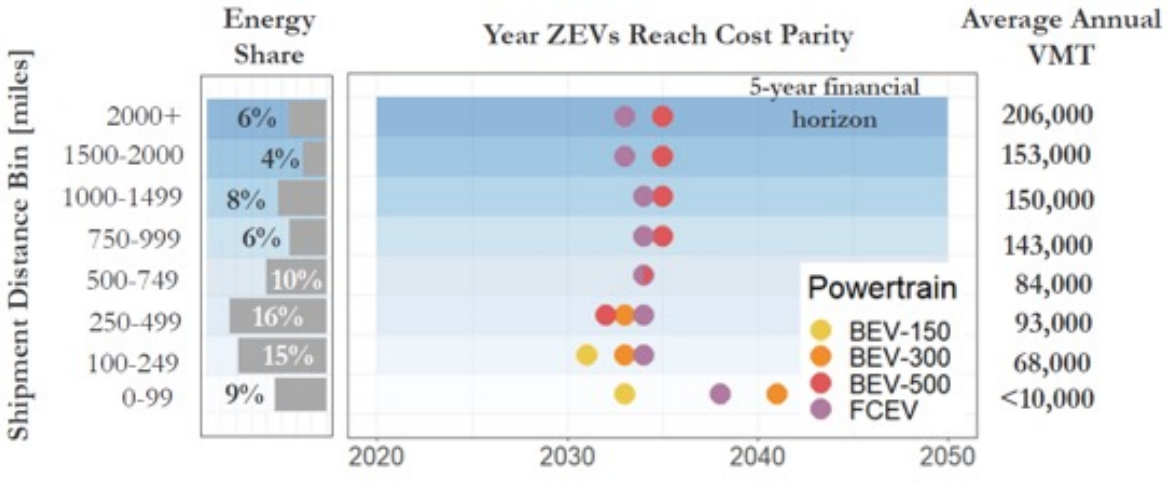
## FIGURE 25. TOTAL COST OF OWNERSHIP FOR CLASS 8 LONG HAUL TRACTORS BY FUEL TYPE




**Source:** Hunter, Chad, et al. "Spatial and Temporal Analysis of the Total Cost of Ownership for Class 8 Tractors and Class 4 Parcel Delivery Trucks". National Renewable Laboratory, NREL/TP-5400-71796, September 2021.

Another NREL report on decarbonizing heavy-duty vehicles published in March of 2022 found that zero-emission vehicle (ZEV) use in the medium and heavy-duty trucking sectors would likely see the deployment of both FCEVs and BEVs, with FCEVs predominating in long-haul applications. It also identified that changes in the speed of cost declines for both underlying energy sources (i.e., electricity, hydrogen) and technology (i.e., batteries, fuel cells) could have a significant impact on which technology is ultimately deployed (Ledna et al. 2022).

## FIGURE 26. COST PARITY POINTS OF ZEVS




**Source:** Ledna, Catherine et al. "Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis." National Renewable Energy Laboratory, March 2022.

Development for both FCEVs and BEVs is advancing quickly. FCEVs manufactured by Hyundai have been deployed in Germany and Switzerland in the past few years, and a coalition of vehicle manufacturers (including Daimler, Honda, and Hyundai) have committed to deploying 10,000 FCEVs in Europe by 2030 (Kurmayer 2021). According to Hyundai Motor Group, production has also started for the U.S. market as well, with 30 of Hyundai's Xcient Fuel Cell truck set to hit streets in a pilot deployment in California in 2023. Given the relative similarities between truck markets across the U.S., it's expected that the successful operation of FCEV trucks on the West Coast would support early uptake in other parts of the country as well (HMG Newsroom 2022).

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## A.7. | Buses

The Strategen analysis of hydrogen use in buses was broken into two separate segments:

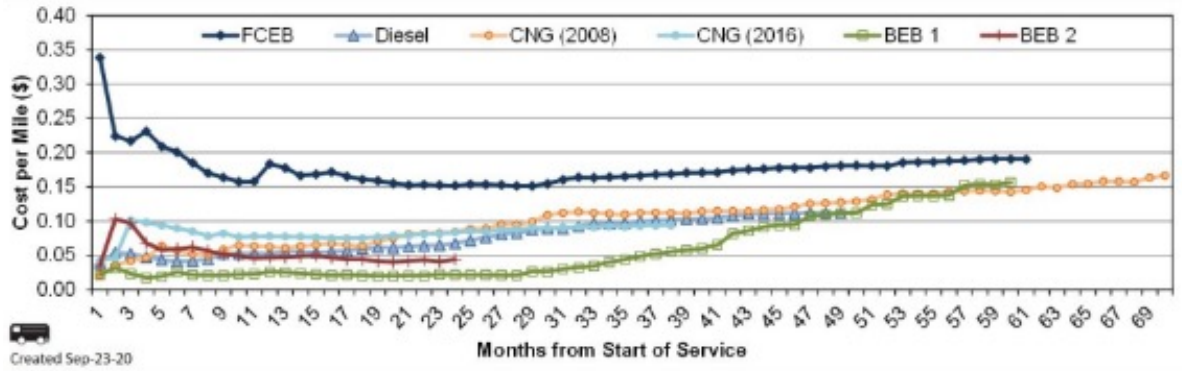
1. Long-distance transport (e.g., coach buses)
2. Commuter transport (e.g., transit and school buses)

Factors such as changes in elevation, route speed, necessary acceleration and deceleration related to traffic, weather, and even the way a specific driver operates the vehicle, all influence the preferred technology of a bus. Fuel cell electric buses perform similarly to conventional diesel and gasoline vehicles both in operation and in their ability to be fueled quickly. The most effective applications for fuel cell buses and battery alternatives will be highly dependent upon the site and operational characteristics of where it will be used.

According to an NREL study, the fuel economy for newly designed fuel cell buses averages 7.95 mi/kg, which equates to 8.99 miles per diesel gallon equivalent and results in an estimated maximum range of 350 miles. Due to the aforementioned factors effecting efficiencies, results will be different for similar buses operated under different conditions. The highest efficiency levels and lowest variability are achieved with highway driving (Eudy and Post 2021).

Commuter buses like transit fleet and school buses incur higher costs per mile when fueled by hydrogen due to maintenance costs on propulsion systems. Ultimately, the cost-effectiveness of hydrogen in buses is largely connected to the mileage and downtime availability of a particular application; for commuter transport, which involves frequent stops over small distances and long periods of non-use, these factors tend to favor electric battery options. The graph below demonstrates the relative cost per mile for fuel cell electric buses (FCEB) compared to battery electric buses (BEB) for commuter-style travel.

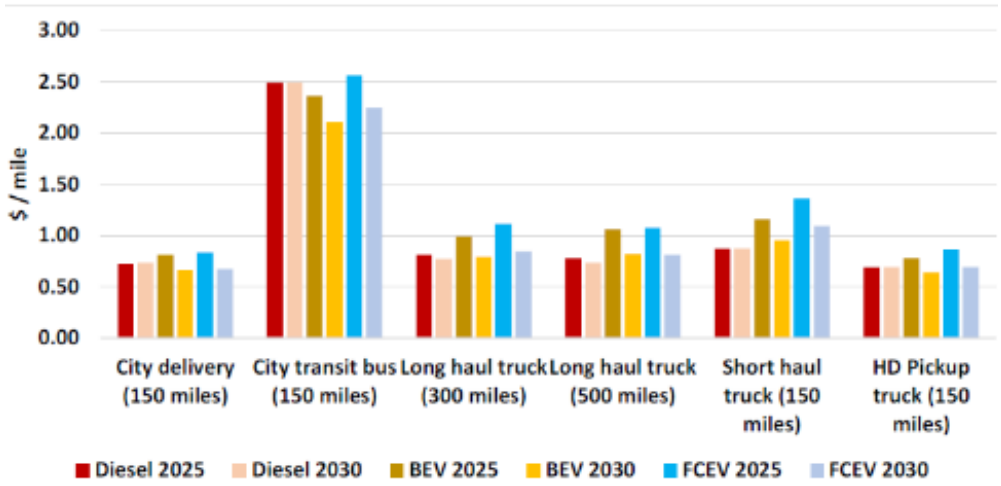
## FIGURE 27. CUMULATIVE MAINTENANCE COSTS PER MILE BY TECHNOLOGY TYPE




**Source:** Eudy, Leslie and Matthew Post. "Fuel Cell Buses in U.S. Transit Fleets: Current Status 2020." National Renewable Energy Laboratory, NREL/TP-5400-75583, March 2021.

However, studies suggest that the total cost of ownership for zero-carbon transit buses, while generally favoring electric versions, is still close enough that hydrogen can still be considered cost competitive. A 2022 study by the UC Davis Institute of Transportation Studies indicated that 15-year total cost of ownership between battery electric and fuel cell buses was similar for both city delivery and city transit applications. In addition, fuel cell buses have been commercially deployed at several transit agencies in California (Eudy, 2021). As a result, although this report assumes that the majority of transit bus needs will likely be served by battery electric vehicles, it does not rule out the possibility that fuel cell buses could be considered in situations where bus routes, re-fueling profiles, and local grid constraints create a better match for fuel cell technology.

## FIGURE 28. TOTAL COST OF OWNERSHIP BY VEHICLE TYPE AND YEAR




**Source:** Burke, Andrew et al. "Evaluation of the Economics of Battery-Electric and Fuel Cell Trucks and Buses: Methods, Issues, and Results." UC Davis Institute of Transportation Studies, 1 August 2022.

### Supporting Research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## A.8. | Passenger Cars

Currently, there are three hydrogen fuel-cell passenger cars on the consumer market in North America: the Toyota Mirai, the Hyundai Nexo, and the Honda Clarity. These cars are all priced above $50,000, out-pricing widely available electric vehicle options from Tesla, Polestar, Chevrolet, and others. The cost to fully charge a market leading Tesla Model 3 averages under $10, lower than the price of a single kilogram of hydrogen at the pump in California ($13.14) as of May 2021, forcing existing manufacturers to offer incentives for consumers, in some cases up to $15,000 worth of hydrogen fuel (Energy Sage News 2022).

In addition to being more expensive in terms of both upfront purchase and fueling costs, hydrogen fuel cell cars require the build-out of a statewide (and ultimately nationwide) network of fueling stations to adequately serve the passenger car market. Although Connecticut does have some hydrogen fueling stations installed already, its network of electric vehicle charging stations is more extensive, creating a strong incentive for customers to choose electric cars over fuel cell versions (Nigro 2016). In addition, electric vehicles have the added benefit of requiring no additional infrastructure for charging at home, which is convenient for typical usage patterns.

Although fuel cell vehicles do have an advantage in driving range and fast refueling, electric vehicle technology is also quickly improving in both range and charging speed for electric vehicles, leading to the rapid growth of the EV market in Connecticut (Connecticut Department of Transportation 2022). This echoes developments in global auto markets, where major manufacturers have been increasingly switching market strategies to target electric vehicles. Beginning in March 2020, three major auto manufacturers—Daimler AG, Volkswagen, and General Motors (GM)—followed the move by Honda to reduce their strategic focus on the hydrogen-powered passenger car market (Palmer 2020).

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## A.9. | Material Handling Equipment

More than 20,000 hydrogen fuel cell forklifts are now in warehouses, stores, and manufacturing facilities throughout the United States. Hydrogen-powered forklifts offer refueling in minutes, increased performance, and zero emissions. Hydrogen-powered vehicles are like their internal combustion engine counterparts in that they can be refilled quickly and easily at a fueling station. They also require less maintenance because they don’t need the watering, equalizing, charging, or cleaning that is required with lead-acid batteries, according to the Hydrogen and Fuel Cells Technology Office. In addition, compared to battery-powered forklifts, fuel cell forklifts perform better on speed, charging time, and space requirements for charging infrastructure (U.S. Department of Energy 2018).

Battery-powered lift trucks lose approximately 14% of their speed over the last half of the battery charge, while fuel cells maintain constant forklift power at all times, even in freezer applications. Compact hydrogen fueling stations are more space-efficient than battery charging rooms, freeing up approximately 7% more valuable warehouse space for other inventory and revenue-generating operations. Battery charging also requires 15 minutes per shift, compared to two minutes for hydrogen refueling. Over a year, that 13 minutes saved per shift represents more than 234 hours of lost productivity per forklift truck in a three-shift operation (Plug Power 2022).

Analysis by the Connecticut Center for Advanced Technology demonstrated that, when considering costs related to forklift downtime and charging space requirements, costs for fuel cell forklifts were roughly $6,400 lower per year than battery-powered forklifts (Rinebold et al. 2018). In recognition of this economic advantage, deployment of fuel-cell forklifts continues to grow globally, particularly in foreign markets (Hydrogen and Fuel Cell Technologies Office 2018). Larger companies with the capital to invest in fuel cell forklifts have found that the lower ongoing costs and improved performance make them a more cost-effective option; it’s expected that as fuel cell costs decrease with expanded manufacturing, market share will increase as smaller businesses are also able to access this technology. There is also opportunity for fuel cells to make inroads into markets for other types of material handling equipment, including those used at maritime ports.

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## A.10. | Ferries

There are few direct cost comparisons of battery-powered electric ferries and hydrogen fuel cell ferries but there are several studies that compare hydrogen fuel cell ferries to conventional diesel ferries. The level of cost-competitiveness for zero-emissions ferry technologies varies by region, location, and application due to factors like existing infrastructure, fuel costs for both hydrogen and electricity, and operational factors such as distance and sailing schedule.

The most competitive applications for hydrogen passenger ferries are those where short docking times may not allow for a battery electric ship to charge because in these cases, an operator would need a larger fleet of electric ferries in order to maintain the same level of service, greatly increasing the total cost of ownership (Hydrogen Council 2020). Another scenario where hydrogen could be a competitive low-carbon alternative is in the case of larger ferries with a motor power of up to 4 MW due to the high size, weight, and cost a battery alternative.

For regional ferries that travel approximately 8 nautical miles roundtrip and have 500 kW motor power, estimates show that hydrogen fuel cell ferries could become cost competitive with battery electric ferries before 2030, and competitive with conventional diesel ferries shortly after 2030 (Hydrogen Council 2020). For a large passenger and cargo ferry that travels approximately 10 nautical miles roundtrip and has a 4 MW engine, the most competitive low-carbon alternative is biodiesel. The fuel cell RoPax is expected to economically compete with biodiesel in 2030, and with conventional diesel by 2035 (Hydrogen Council 2020).

The current estimated TCO for small passenger and cargo ferry boats with engine power of 430 kW is $1.06 per passenger, assuming hydrogen fuel costs of $5/kg. If the hydrogen fuel cost reached $3.50/kg, the estimated TCO may reach as low as $0.67 per passenger, compared to an estimated $0.65 per passenger for a comparable diesel ferry. In the case of small high-speed ferries with an engine power of approximately 1600 kW, the current estimated TCO per passenger is $2.66. With a reduction in hydrogen fuel costs to $3.50/kg, the TCO could decrease to $1.56, compared to $1.53 for a conventional diesel alternative. Further, by decreasing the amount of onboard hydrogen storage, the TCO could further decrease to $1.40 per passenger (Ahluwalia et al. 2021).

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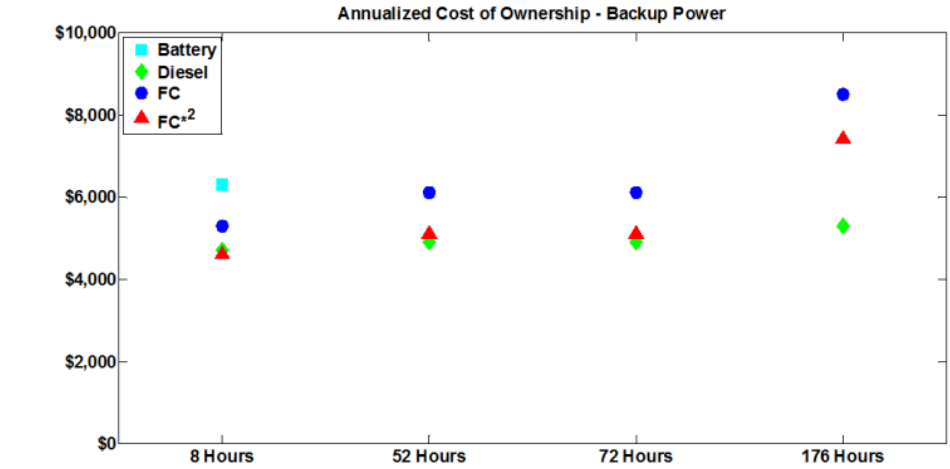
## A.11. | Critical Facilities

According to the Federal Emergency Management Agency (FEMA), typical critical facilities include hospitals, fire stations, police stations, storage of critical records, and similar facilities (Federal Emergency Management Agency 2023). Traditionally, critical facilities have relied on back-up generators, typically diesel generators, to ensure power availability. For example, hospitals in Connecticut are required to have enough on-site backup power to cover load for 24 hours, regardless of how often outages of this length occur (Clean Energy Group 2015). However, backup generators can frequently fail when called upon. For example, during Superstorm Sandy, the New York University Langone Medical Center was forced to evacuate its patients due to the failure of backup generators (Olinsky-Paul 2013). Backup diesel generators also have high emissions of both carbon dioxide and local pollutants.

Fuel cells have and batteries have been identified as a potential carbon-free alternative to diesel generators. Analysis by NREL has found that for longer-term outages (i.e., 52 hours or more), fuel cells provide a more cost-effective back-up power solution than batteries (Kurtz et al. 2014). The results of this analysis are shown in Figure 29.

### FIGURE 29. FUEL CELL BACKUP POWER COST OF OWNERSHIP




| | 8 Hours | 52 Hours | 72 Hours | 176 Hours |
|---|---|---|---|---|
| Battery | $6300 | $24800 | $31300 | $67200 |
| Diesel | $4700 | $4900 | $4900 | $5300 |
| FC | $5300 | $6100 | $6100 | $8500 |
| FC*2 | $4600 | $5100 | $5100 | $7400 |

NREL odp_bu_30
Created: Aug-29-14 1:26 PM | Data Range: 2010Q1-2013Q4

1) Refer to the report for complete analysis details and assumptions (http://www.nrel.gov/docs/fy14osti/60732.pdf).
2) Fuel cell system with incentives (FC*), calculated as 30% of expenditures and capped at $3,000/kW of system capacity.

Fuel Cell* includes incentives

**Source:** Kurtz, J. et al. "Backup Power Cost of Ownership Analysis and Incumbent Technology Comparison" National Renewable Energy Laboratory, NREL/TP-5400-60732, September 2014.

Market research by Battelle has identified telecom towers as a potential early market for fuel cell back-up technology, given the needs to weather longer-term outages and relative insensitivity to upfront capital costs (Mehadevan et al. 2007).

Data centers are also a potential market for fuel cell backup power, given their need for continuous 24/7 power (requiring back-up power run times of up to 48 to 72 hours) and the carbon emission reduction commitments of many players in this space (Saur et al. 2019). Since the first deployment of fuel cell in at least 100 telecommunications towers as backup power in 2011, more and more states have started investing in fuel cell systems for critical facilities. New York State, for example, invested $15 million in 2018. Additionally, Connecticut already has fuel cells deployed at several hospitals throughout the state, indicating their fit for applications with long back-up power requirements (Clean Energy Group 2015).

### Supporting Research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## A.12. | Rail

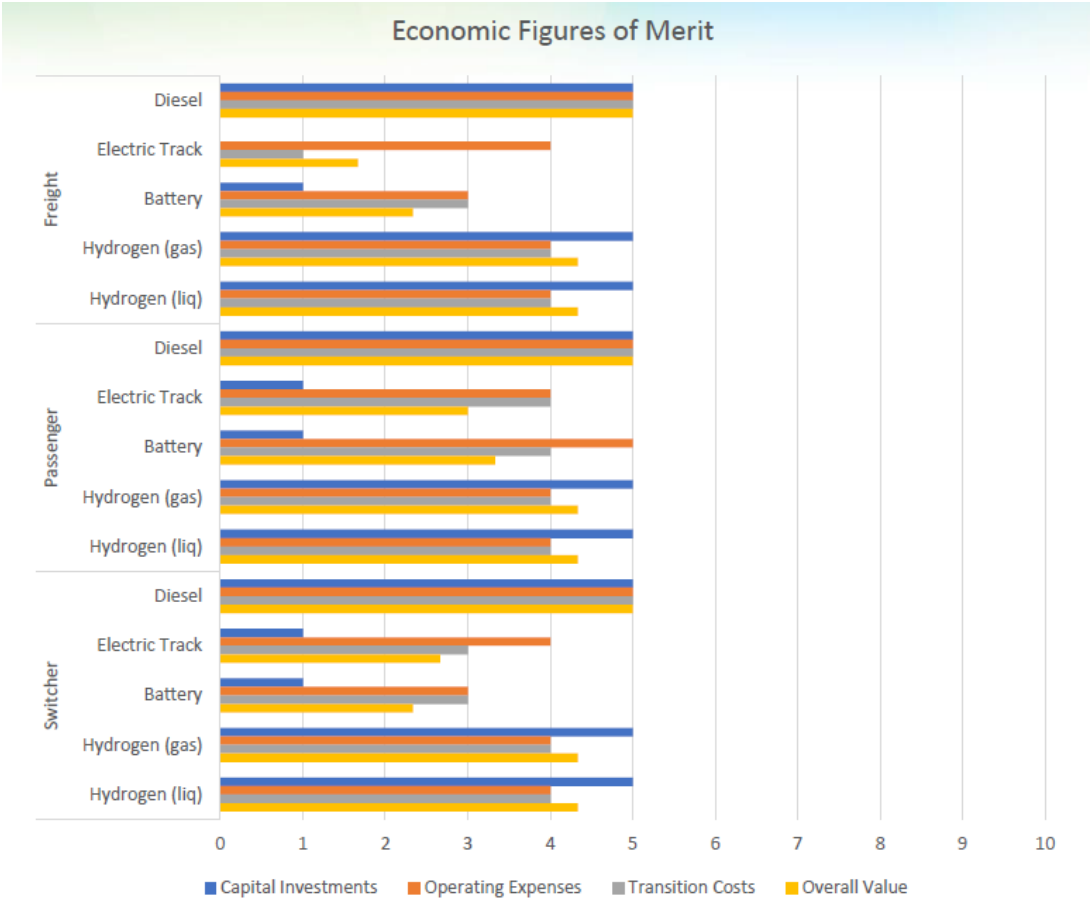
Hydrogen can provide many benefits to rail locomotive power operations, specifically offering interoperability, scalability, fast-refueling, and lightweight energy storage at scale. Hydrogen fuel cell powered locomotives can run on existing tracks, so while the purchase of new hydrogen locomotives may be expensive, they avoid the need for expensive electrification of the track itself. Moreover, hydrogen fuel cells offer a longer range and faster fueling than electric alternatives, making them a competitive low-cost option (Burgess 2021).

A review by Barbosa distinguishes the advantages of different types of fuel cells for different rail types. Polymer electrolyte membrane fuel cells (PEMFC), which operate at moderate temperatures (80 °C) and is best fitted to non-permanent demand cycles, has been proposed for applications like light rail and trams, commuter and regional trains, shunt/switch locomotives, and underground mine locomotives. Meanwhile, solid oxide fuel cells (SOFC), which have higher efficiency than other types of fuel cells but need to work at a high operating temperature (1,000 °C) could be a promising technology for freight or heavy haul locomotives, given their steady duty cycles (Barbosa 2019).

Regarding the life-cycle cost of light rail vehicles, an analysis by Sun et al. predicts that as the cost of hydrogen and fuel cells fall, fuel cell hybrid trams will become progressively more competitive. Similarly, a techno-economic analysis by Zenith et al. 0 also suggests that there is potential for fuel cell and battery technologies to replace diesel on railways with low traffic volumes. Further, analysis by Sandia National Laboratory assessed hydrogen trains against electric solutions, developing a comparison across several systems of merit, including economic cost-competitiveness. Their system ranked each metric on a scale of 1 to 10, with 10 being the best. The Sandia's assessment demonstrates that hydrogen-powered rail can provide significant economic benefits compared to battery-electric rail, particularly for freight or switcher rail lines (Erhart 2019). However, other studies show that the economics for hydrogen-fueled and electric power trains are close for many use cases (Ruf et al. 2019), or, in some cases, battery-powered rail cars have been demonstrated to be more cost effective (Cuenca 2020).

Electrified train systems continue to be deployed in many regions, including in Connecticut, where it was recently announced the state would replace diesel trains with electric trains on the Shore Line East route that provides daily service from New Haven to New London (Lewis 2022).

## FIGURE 30. SANDIA ASSESSMENT OF HYDROGEN MERIT FOR RAIL APPLICATIONS




**Source:** Erhart, Brian et al. "Impact of Hydrogen for Rail Applications." Sandia National Laboratory. Presentation in Lansing, Michigan, 27 March 2019.

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## A.13. | Hydrogen Blending

Hydrogen can be blended into most existing natural gas pipelines at low percentages. Demonstration projects in Europe have found that 15-20% blends by volume are possible before major retrofits are required (Raju 2022). Due to the lower volumetric energy density of hydrogen, a 20% blend by volume would equate to about a 7% blend by energy content. This means that the maximum blend limit can only reduce emissions from the gas system by around 7%, making it an incomplete climate mitigation solution. For core gas customers (i.e., residential and commercial customers), falling costs in heat pump technologies make heat electrification a more cost-effective method for reducing gas use when compared on a per-MMBtu reduction basis.[235]

NREL's Electrification Futures Study (2016) forecasted that heat pump technology improvements would make air source heat pumps the most cost-effective heating technology for residential and commercial in the 2040-2050 timeframe. Since Connecticut currently has a target for 100% zero-carbon electricity in 2040, it follows that heat electrification will ultimately be the most cost-effective option for reducing carbon emissions for core customers, even assuming hydrogen blends are kept at a level that avoids infrastructure upgrades. This is supported by a review of systems-level decarbonization modeling studies, all but one of which did not incorporate hydrogen in final energy delivery for building heat.

235 Developed from calculations based on cost data from Jadun 2017. High installation rates of air source heat pumps will likely require upgrades to electrical infrastructure, adding additional costs. However, these costs are highly location-specific and are beyond the scope of this project to assess.

However, existing analysis does support hydrogen blending for non-core customers (e.g., industrial and power sector customers). In these cases, blending hydrogen with biogas can provide a lower-cost solution decarbonization solution than electrification, which is much more expensive for high-heat processes. Analysis by Oberg et al. (2022) found that gas turbines running a blend of 30% hydrogen by volume were a cost-effective method of providing seasonal storage in grids with high penetration of renewables. This blended rate was chosen even when the model had the option to include higher-hydrogen blends, including up to 100% hydrogen. In addition, three out of four systems-level decarbonization studies reviewed had some level of hydrogen blending in industrial and/or power sector gas feedstocks (Larson 2021; Williams 2014; Sustainable Development Solutions Network 2020).

Hydrogen blending for non-core customers could be achieved by blending hydrogen directly at the non-core customers' facilities. This would require an assessment of the customer's facility to determine that hydrogen can be blended directly into their fuel feedstock without affecting operation or increasing pollutant emissions from their facility. However, because this customer would be the only facility using hydrogen in this case, this assessment would only need to take into account the impact of hydrogen blending on equipment at that customer's premises.

Hydrogen can also be delivered to non-core customers by blending it into the main gas network. However, this would deliver hydrogen to all customers connected to the gas network, including residential and commercial customers. This would require a broader assessment to understand how hydrogen would interact with the gas distribution system in Connecticut, which would likely take longer than facility-level assessments. For example, California recently completed an assessment of hydrogen blending in the state's gas distribution system that concluded hydrogen could likely be safely blended into the gas distribution system at a ratio of 5% by volume, but that additional demonstration projects would be required to ensure at-scale viability (Raju 2022).

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## A.14. | Systems-Level Analysis

Four modeling studies looking at national or global decarbonization pathways were referenced to assess how hydrogen was most cost-effectively allocated when considered in the context of an optimized economy-wide model. Although these studies did not engage with all end uses discussed above (e.g., forklifts, critical facilities), their results broadly supported the assessment above. Across all four studies, hydrogen was most consistently deployed in power generation, heavy-duty vehicles, maritime shipping, aviation, industrial heat, and blending for non-core customers. The graph below summarizes where hydrogen use is proposed for each study referenced. Green-colored squared indicating where hydrogen plays a significant role, while white-colored squared indicating where hydrogen is not used significantly or otherwise not mentioned.

+ Study 1: International Energy Agency 2021, “Net Zero by 2050”
+ Study 2: Larson 2021: “Net-Zero America: Potential Pathways, Infrastructure, and Impacts Final Report”
+ Study 3: William 2014, “Pathways to deep decarbonization in the United States”
+ Study 4: Sustainable Development Solutions Network 2020, “Zero Carbon Action Plan”

### TABLE 6. SYSTEMS-LEVEL ANALYSIS OF HYDROGEN APPLICATIONS

| | Study 1 | Study 2 | Study 3 | Study 4 |
|---|---|---|---|---|
| Aviation | X | | | |
| Blending for Core Customers | X | | | |
| Blending for Non-Core Customers | X | X | X | |
| Buses | | | | X |
| Heavy-Duty Vehicles | X | X | X | X |
| Industrial Heat | X | X | | X |
| Light-Duty Vehicles | X | | | |
| Maritime Shipping | X | | | X |
| Power Generation | X | X | X | X |
| Residential/Commercial Heat (100% | | | | |

**Supporting Research:**


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# Appendix B: Hydrogen Demand Analysis

Appendix B provides an overview of the methodology and sources utilized by Strategen Consulting to assess the scale of hydrogen use that could be expected from the highest priority end uses in Connecticut. The highest priority end uses for hydrogen as determined by the Task Force include aviation, maritime shipping, critical facilities, material handling, long-haul trucking, power generation, and high heat industrial uses. Based on expected changes in energy use in Connecticut over the next few decades, Strategen's assessment found that hydrogen demand could scale from 25.2 kilotonnes (kt) per year in 2030 to 200.5 kt per year in 2040 and 335.5 kt per year in 2050. The majority of this demand is expected to be driven by power generation and long-haul heavy-duty vehicles.

### TABLE 7. OVERVIEW OF DEMAND METHODOLOGY AND SUPPORTING RESEARCH BY HYDROGEN END USE

| End Use | Description of Methodology |
|---|---|
| Aviation | Assumed hydrogen use at the scale required for sectoral decarbonization in Mission Possible Project's "Optimistic" scenario. |
| Critical Facilities | Assumed fuel cell backup capacity at data centers, hospitals, telecom towers, and facilities with behind-the-meter generation assets greater than 100 kW. |
| High-Heat Industry | Based on high-heat industrial processes' share of 2020 industrial gas demand, scaled up according to the industrial energy growth rate from 2010-2019. |
| Long-Haul Trucking | Assumed sales of long-haul fuel cell trucks begin in 2028 and scale up to reach 90% of sales over 10 years. Also assumed a truck lifespan of 10 years. |
| Maritime Shipping | Assumed hydrogen use at scale forecasted by the American Bureau of Shipping's "Zero Carbon Outlook" report. |
| Material Handling | Assumed fuel cell forklift sales in Connecticut began in 2020 and scale up to reach 40% of all forklift sales in 10 years. Also assumed a forklift lifespan of 4 years. |
| Power Generation | Assumed thermal generation in 2050 in line with E3's "Net Zero New England" report, with Connecticut's generation consistent with its share of ISO-NE fossil fuel generation in 2021. |

The sources utilized to calculate hydrogen demand in priority end uses are listed below.

### Aviation


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### Critical Facilities


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# Appendix C: Hydrogen Supply Summary

Appendix C provides an overview of the methodology, data and assumptions utilized by Strategen to quantify the technical potential of clean hydrogen produced from different sources in the state of Connecticut. The technical potential was assessed for three supply cases (low, medium, and high) defined in Section 4.1.4. The production sources discussed in this section include solar, onshore wind, offshore wind, biogas, and nuclear energy. This appendix also includes an overview of the assumptions utilized regarding the energy and hydrogen production technologies, such as forecasted costs, lifetimes, and efficiency of the assets, as well as the applicable tax credits from the Inflation Reduction Act passed by the U.S. Congress in 2022. This appendix concludes with projected levelized costs of hydrogen (LCOH) and accompanying supply curves for each production technology and supply scenario.[236]

236 LCOH values provide the levelized cost of hydrogen at point of production and don't include costs for compression, transportation, storage, or distribution infrastructure.

Table 8, below, identifies the technical production potential for each clean energy source located within Connecticut state boundaries or, in the case of offshore wind, within an accessible distance from Connecticut. These technical potentials include resources that are already built, planned, or contracted for as part of the total estimate of available capacity. The "IRP Add." column provides the amount of incremental capacity for each clean energy source that is expected to be required to meet Connecticut's 100% zero-carbon electricity target (Schatzki 2022).

## TABLE 8. CLEAN ENERGY TECHNICAL PRODUCTION POTENTIAL IN CONNECTICUT

| Clean Energy Source | IRP Add. | Technical Production Potential | | | Sources for Technical Production Potentials |
|---|---|---|---|---|---|
| | | Low Case | Mid Case | High Case | |
| **Total solar generation capacity (MW)** | **2,300** | **27,854** | **119,153** | **119,153** | NREL Solar Supply Curves |
| **Total onshore wind generation capacity (MW)** | **400** | **112** | **1,794** | **1,794** | NREL Wind Supply Curves |
| **Total offshore wind generation capacity (MW)** | **4,700** | **24,809** | **24,809** | **66,344** | Lopez (2022) |
| **Biogas production potential (Trillion Btu)** | **0** | **3.2** | **5.7** | **5.7** | American Gas Foundation (2019) |
| **Nuclear production capacity (MW)** | **0** | **47.7** | **95.4** | **190.8** | Assumptions developed from communications with Dominion |

All renewable energy LCOE's were calculated using the NREL Annual Technology Baseline (ATB) model and include tax credits provided by the Inflation Reduction Act. Capacity factors for onshore wind and solar are the average capacity factors in the state according to the NREL supply curves referenced in Table 8. Capacity factors for offshore wind were chosen based on the highest capacity factor available for fixed-bottom offshore wind in NREL's Annual Technology Baseline model that did not exceed the capacity factor used by DEEP in its 2021 Deep Decarbonization Integrated Resource Plan (Connecticut Department of Energy and Environmental Protection 2021).

## TABLE 9. RENEWABLE ENERGY INPUTS

| Input | Value | Unit | Source |
|---|---|---|---|
| **Solar Capacity Factor** | **16.7%** | % | **NREL** |
| **Onshore Wind Capacity Factor** | **40%** | % | **NREL** |
| **Offshore Wind Capacity Factor** | **48%** | % | **NREL ATB** |
| **Solar LCOE (2030)** | **$25.80** | **$/MWh** | **NREL ATB** |
| **Solar LCOE (2040)** | **$30.40** | **$/MWh** | **NREL ATB** |
| **Onshore Wind LCOE (2030)** | **$19.10** | **$/MWh** | **NREL ATB** |
| **Onshore Wind LCOE (2040)** | **$24.90** | **$/MWh** | **NREL ATB** |
| **Offshore Wind LCOE (2030)** | **$43.60** | **$/MWh** | **NREL ATB** |
| **Offshore Wind LCOE (2040)** | **$44.30** | **$/MWh** | **NREL ATB** |

Cost estimates for electrolyzer capital expenditures were sourced from the International Council on Clean Transportation (Christensen 2020), which reported several different forecasts for various electrolyzer technologies across time intervals (e.g., 2025, 2030, 2050). Strategen analysis utilized an average of the International Council on Clean Transportation forecasts and assumed linear cost reductions between intervals. The feasibility of these forecasts and other inputs were confirmed in direct communication with representatives from Nel Hydrogen. Alkaline electrolyzers were assumed as the default technology in all cases, although representatives from Nel confirmed that costs for proton exchange membrane (PEM) electrolyzers would likely be within the same range by 2030.

## TABLE 10. LCOH CALCULATION INPUTS - ELECTROLYSIS

| Input | Value | Unit | Source |
|---|---|---|---|
| Electrolyzer CapEx (2030) | 442 | $/kW | Christensen (2020) |
| Electrolyzer CapEx (2040) | 293 | $/kW | Christensen (2020) |
| Stack Life | 80,000 | Hours | Christensen (2020) |
| Stack Rebuild Cost | 50% | % of Initial CapEx | Christensen (2020) |
| Annual Fixed O&M | 2% | % of Initial CapEx | Christensen (2020) |
| Plant Electrical Efficiency | .0185 | $H_2$kg/kWh | Bloom Energy |
| Cell Degradation Rate | .15% | % per 1,000 Hours | Ginsberg (2022) |
| Plant Economic Life | 20 | Years | Nel (Interview) |
| Production Tax Credit | $.03 | $/kg$H_2$ | Inflation Reduction Act |
| Cost of Capital | 6% | % | Assumption |

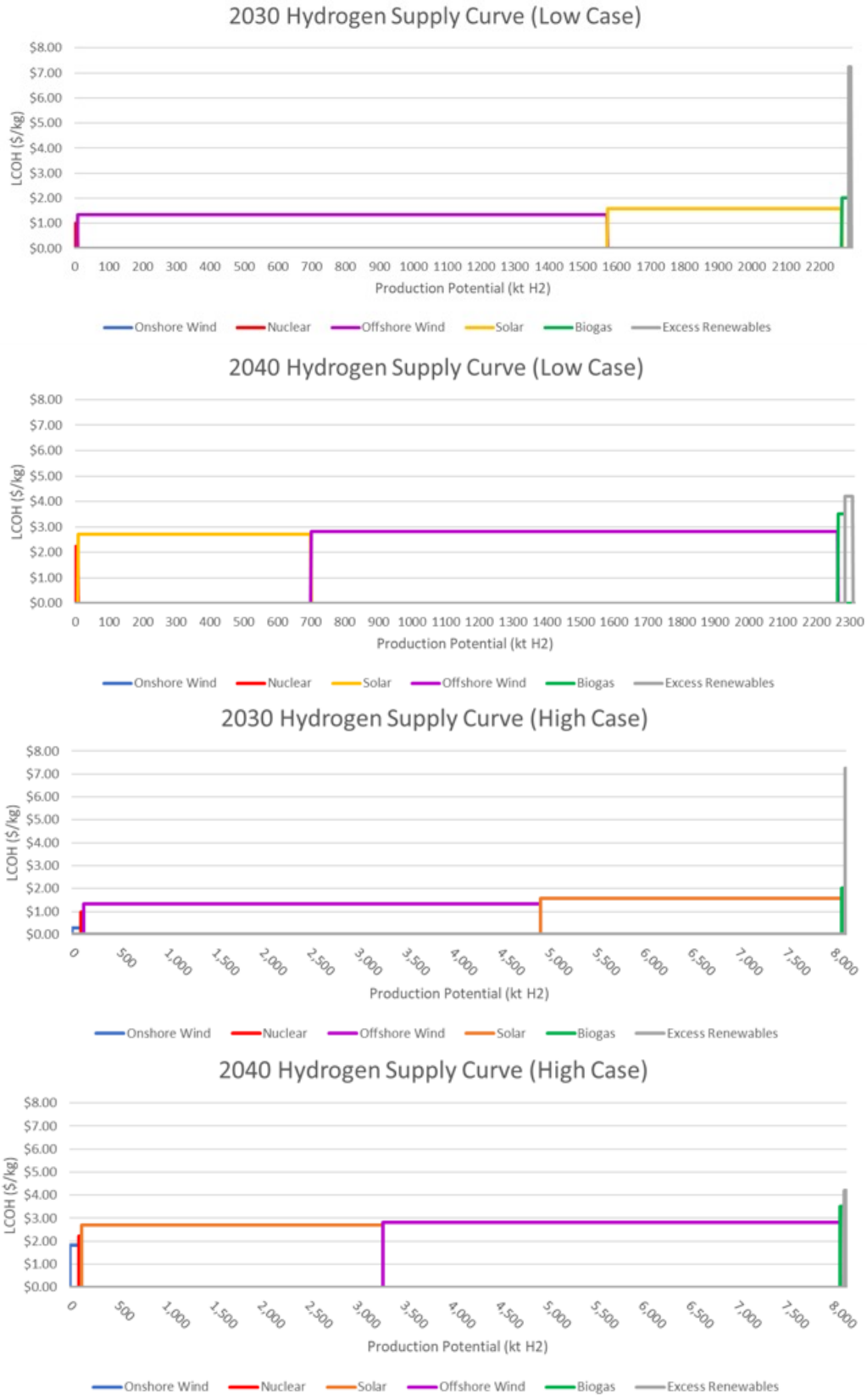
Table 10 provides the inputs that, in addition to the underlying cost of electricity, were used to assess the cost of producing hydrogen from electrolysis. Table 11 provides the inputs that were used to estimate the cost of producing hydrogen from steam methane reformation of biogas.

## TABLE 11. LCOH CALCULATION INPUTS – STEAM METHANE REFORMATION

| Input | Value | Unit | Source |
|---|---|---|---|
| LCOH w/ Fossil Gas Reformation | $1.06 | $/kgH2 | Lewis (2022) |
| Fuel Portion of SMR LCOH | $0.77 | $/kgH2 | Lewis (2022) |
| Estimated Natural Gas Price | $4.42 | $/MMBtu | Lewis (2022) |
| Estimated RNG Price | $18.55 | $/MMBtu | American Gas Foundation 2019 |

Figure 31 shows the LCOH, in $/kg, of hydrogen in 2030 and 2040 in the low and high production scenarios. These values represent the price at point of production, and do not include cost of hydrogen infrastructure (e.g., pipelines compressors, storage). Estimates assume hydrogen producers meet the labor requirements needed to receive full production tax credit.

## FIGURE 31. HYDROGEN SUPPLY CURVES – LOW AND HIGH CASES




**Source:** Strategen Consulting

## Supporting Research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# Appendix D: Funding Opportunities Summary

Table 12 was compiled by the Funding Working Group to provide an overview of potential federal funding sources that may be applied to hydrogen-related projects and infrastructure. This resource should be used for informational purposes only and may not encapsulate all potentially applicable federal funding opportunities. This resource reflects information available as of December 2022 and details may be subject to change. Readers should review these programs and form their own conclusions of its applicability.

## TABLE 12. OVERVIEW OF FEDERAL FUNDING OPPORTUNITIES FOR HYDROGEN

| RELEVANT APPLICATIONS | PROGRAM NAME | FUNDING SOURCE | ADMINISTRATOR | TOTAL FUNDING | DESCRIPTION | FUNDING TYPE | NON-FEDERAL MATCH REQUIREMENTS | NOTES |
|---|---|---|---|---|---|---|---|---|
| **Aviation** | Airport Infrastructure Grant Program | IIJA | DOT - FAA | $15 billion | Grants for airport infrastructure projects that increase safety and expand capacity, including sustainability projects. | Formula Grants | None | Program Overview<br><br>Available through 2026 |
| **Aviation** | Airport Terminal Program | IIJA | DOT - FAA | $5 billion | Grants will fund safe, sustainable and accessible airport terminals, on-airport rail access projects and airport-owned airport traffic control towers. | Competitive Grants | 20% for large and medium hub airports; 5% for remainder of eligible airports | Program Overview<br><br>$1 billion available annually through 2026 |
| **Aviation** | Alternative Fuel and Low-Emission Aviation Technology Program | IRA | DOT - FAA | $291.1 million | A portion will support projects related to production, transportation, blending, or storage of SAF ($244.5 million). Another portion will go to projects related to low-emission aviation technologies, a broadly defined term that encompasses any technologies that improve fuel efficiency, increase the utilization of SAF, or reduce aircraft emissions ($46.5 million). | Competitive Grants | 25%;<br>10% for small hub airport or non-hub airport | Progam Summary<br><br>(Webpage Not Yet Available) |
| **Aviation Heavy Duty Trucks** | Strengthening Mobility and Revolutionizing Transportation (SMART) Grants | IIJA | DOT | $500 million | Provide grants to eligible public sector agencies to conduct demonstration projects focused on advanced smart community technologies and systems in order to improve transportation efficiency and safety. | Competitive Grants | 20% for large and medium hub airports; 5% for remainder of eligible airports | Program Overview |
| **Buses** | Clean School Bus Program | IIJA | EPA | $5 billion | Supports the purchase or lease of zero-emission and alternative fuel transit buses and to purchase, construct, or lease bus related facilities. | Grants and Rebates | None | Program Overview<br><br>Available through 2026 |

| RELEVANT APPLICATIONS | PROGRAM NAME | FUNDING SOURCE | ADMINISTRATOR | TOTAL FUNDING | DESCRIPTION | FUNDING TYPE | NON-FEDERAL MATCH REQUIREMENTS | NOTES |
|---|---|---|---|---|---|---|---|---|
| **Buses** | Low or No Emission Bus and Bus Facilities Grants | IIJA | DOT - FTA | $5.6 billion | Supports the purchase or lease of zero-emission and low-emission transit buses and to purchase, construct, or lease bus related facilities. | Formula Grants | 15% for buses, 10% for infrastructure | Program Overview<br><br>Available through 2025 |
| **Cargo Ships Materials Handling** | America's Marine Highway Program Grants | IIJA | DOT - MARAD | $25 million | Develop and expand marine highway service options and facilitate their further integration into the current U.S. surface transportation system. | Competitive Grants | 20% | Program Overview |
| **Cargo Ships Materials Handling** | Port Infrastructure Development Program Grants | IIJA | DOT - MARAD | $2.25 billion | Supports port electrification, microgrids, and hydrogen refueling infrastructure for medium or heavy-duty trucks that service the port. $400 million specifically for reducing idling truck emissions. | Competitive Grants | 20% | Progam Overview |
| **Critical Facilities** | Building Resilient Infrastructure and Communities | IIJA | DHS - FEMA | $1 billion | Pre-disaster mitigation program supporting states, local communities, tribes and territories undertaking hazard mitigation projects to reduce the risks they face from disasters and natural hazards. | Competitive Grants | 25% typically, 10% for small and impoverished communities | Program Overview |
| **Critical Facilities Microgrids** | Preventing Outages and Enhancing the Resilience of the Electric Grid Grants | IIJA | DOE - GDO | $5 billion | Prevent outages and enhance the resilience of the electric grid. Eligible uses include activities that reduce the likelihood and consequences of disruptive events. | Grant | Unknown | Program Overview<br><br>Available until expended |
| **Critical Facilities Microgrids** | Program Upgrading Our Electric Grid and Ensuring Reliability and Resiliency | CHIPS | DOE | $5 billion | To coordinate and collaborate with electric sector owners and operators—(A) to demonstrate innovative approaches to transmission, storage, and distribution infrastructure to harden and enhance resilience and reliability; and (B) to demonstrate new approaches to enhance regional grid resilience, implemented through States by public and rural electric co-operative entities on a cost-shared basis. | Grant, Cooperative Agreement or Other | 20% for R&D, 50% for commercial | Program Overview<br><br>$1 billion annually through 2026 |
| **Harbor Craft** | Construction of Ferry Boats and Ferry Terminal Facilities | IIJA | DOT - FHWA | $912 million | Increases funding for the ferry boat program, which funds the construction of ferry boats and ferry terminal facilities. | Competitive Grants | 20% | Program Overview |

| RELEVANT APPLICATIONS | PROGRAM NAME | FUNDING SOURCE | ADMINISTRATOR | TOTAL FUNDING | DESCRIPTION | FUNDING TYPE | NON-FEDERAL MATCH REQUIREMENTS | NOTES |
|---|---|---|---|---|---|---|---|---|
| **Harbor Craft** | Electric or Low Emitting Ferry Program | IIJA | DOT - FTA | $250 million | Supports the purchase of electric and low-emission ferries. | Competitive Grants | 20% | Program Overview<br><br>$50 million annually through 2026 |
| **Rail** | Consolidated Rail Infrastructure and Safety Improvement Grants | IIJA | DOT - FRA | $5 billion | Funds projects that improve the safety, efficiency, and reliability of intercity passenger and freight rail. | Competitive Grants | 20% | Program Overview |
| **Heavy Duty Trucks** | Carbon Reduction Program | IIJA | DOT - FHWA | $6.4 billion | Supports the development of alternative fuel vehicles, including: publicly accessible H2 fueling and zero-emission construction equipment and vehicles (incl. supporting facilities). | Formula Grants | 20% typically, 10% for interstate | Program Overview<br><br>~$1.3 billion available annually through 2026 |
| **Heavy Duty Trucks** | Clean Heavy Duty Vehicles | IRA | EPA | $1 billion | Supports the replacement of existing Class 6 and Class 7 trucks (buses, garbage trucks, and other similarly sized vehicles) with zero-emission vehicles, as well as the construction and operation of associated charging or fueling infrastructure. 40% must go to non-attainment areas. | Grants and Rebates | Unknown | Program Overview<br><br>Available through 2031 |
| **Heavy Duty Trucks** | Reduction of Truck Emissions at Port Facilities | IIJA | DOT – FHWA | $400 million | Funding to study and provide grants to reduce idling at port facilities, including through the electrification of port operations. | Grant - Unknown | 20% | Program Overview |
| **Heavy Duty Trucks Buses** | Alternative Fuel Refueling Property Tax Credit | IRA | USDT - IRS | 6% base, 30% with added requirements | Tax credits for the cost of an alternative fuel vehicle refueling property. Property must be sited within a low-income or rural census tract area. | Tax Credits | None | Program Overview<br><br>Valid for any property placed in service before 2033; includes direct payment |

| RELEVANT APPLICATIONS | PROGRAM NAME | FUNDING SOURCE | ADMINISTRATOR | TOTAL FUNDING | DESCRIPTION | FUNDING TYPE | NON-FEDERAL MATCH REQUIREMENTS | NOTES |
|---|---|---|---|---|---|---|---|---|
| **Heavy Duty Trucks Buses** | Commercial Clean Vehicle Credit | IRA | USDT - IRS | Tax credit equal to the lesser of the following: | Tax credits for the cost of an alternative fuel vehicle refueling property. Property must be sited within a low-income or rural census tract area. | Tax Credits | None | Program Overview<br><br>Maximum per recipient: $7,500 for < 14,000 lbs $40,000 for > 14,000 lbs<br><br>No domestic or assembly requirements |
| **Heavy Duty Trucks Buses Materials Handling** | Congestion Mitigation and Air Quality Improvement Program | IIJA | DOT - FHWA | $13.2 billion | Added eligibility for the purchase of medium- and heavy-duty zero-emission vehicles, nonroad vehicles from construction or port-related freight, and related charging/fueling equipment. | Formula Grants | 20% typically, 10% for interstate | Program Overview<br><br>~2.6 billion available annually through 2026 |
| **Heavy Duty Trucks Light Duty Vehicles** | Charging and Fueling Infrastructure Grants | IIJA | DOT | $2.5 billion | Support development of alternative fueled infrastructure, including hydrogen fueling stations. | Competitive Grants | Unknown | Program Overview<br><br>~$1.3 billion available annually through 2026 |
| **Industrial** | Industrial Emission Demonstration Projects | IIJA | DOE - OCED | $500 million | To fund demonstration projects that test and validate technologies that reduce industrial emissions. | Competitive Grants | TBD | Program Overview<br><br>Available until expended |
| **Infrastructure** | Natural Gas Distribution Infrastructure Safety and Modernization Grants | IIJA | DOT-PHMSA | $1 billion | Grants to repair, rehabilitate, or replace its natural gas distribution pipeline systems or portions thereof or to acquire equipment to (1) reduce incidents and fatalities and (2) to avoid economic losses. | Competitive Grants | None | Program Overview<br><br>$200 million available annually through 2026 |
| **Manufacturing** | Advanced Energy Project Tax Credit | IRA | USDT - IRS | $10 million available, 30% of amount invested | Tax credits for the cost of new or upgraded factories to build specified renewable energy components (fuel cells qualify). | Tax Credits (competitive application) | — | Program guidance anticipated in 2023 |
| **Manufacturing** | Advanced Technology Vehicle Manufacturing Loan Program | IRA | DOE - LPO | $3 billion | Expands authorities to lend under this program, which aims to produce advanced technology for medium and heavy-duty vehicles, trains or locomotives, maritime vessels, aircraft, or hyperloop technology. | Loans | None | Program Overview<br><br>Available through 2028 |

| RELEVANT APPLICATIONS | PROGRAM NAME | FUNDING SOURCE | ADMINISTRATOR | TOTAL FUNDING | DESCRIPTION | FUNDING TYPE | NON-FEDERAL MATCH REQUIREMENTS | NOTES |
|---|---|---|---|---|---|---|---|---|
| **Manufacturing** | Clean Hydrogen Manufacturing Recycling Research, Development, and Demonstration Program | IIJA | DOE - EERE | $500 million | Advance new clean hydrogen production, processing, delivery, storage and use equipment manufacturing technologies and techniques. | Grants - Unknown | Unknown | Program Overview<br><br>Available until expended |
| **Manufacturing** | Domestic Manufacturing Conversion Grants | IRA | DOE | $2 billion | Provides grants for domestic production of plug-in electric hybrid, plug-in electric drive, and hydrogen fuel cell electric vehicles and components of such vehicles. | Competitive Grants | 50% | Program Overview<br><br>Available through 2031; priority given to the refurbishment or retooling of manufacturing facilities that have recently ceased operation or will cease operation in the near future. |
| **Manufacturing Production** | Defense Production Act Funding | IRA | DOE | $500 million | Provides the DOE with the authority to utilize the Defense Production Act (DPA) to accelerate domestic production of key energy technologies, including electrolyzers, fuel cells, and platinum group metals. | Unknown | Unknown | Guidance in Development |
| **Materials Handling** | Grants to Reduce Air Pollution at Ports | IRA | EPA | $3 billion | Grants are directed to purchase and install zero-emission equipment and technology at ports, as well as the development of climate action plans at ports. $750M to be directed at ports in nonattainment areas. | Competitive Grants | None | Program in Development<br><br>Available through 2027 |
| **Microgrids Electric Sector** | Energy Improvement in Rural and Remote Areas | IIJA | DOE - OCED | $1 billion | Provide financial assistance to improve, in rural or remote areas of the United States, the resilience, safety, reliability, and availability of energy. This program includes funding of microgrids. | Grant, Cooperative Agreement or Other | Unknown | Program Overview<br><br>$200 million available annually through 2026 |
| **Production** | Clean Hydrogen Electrolysis Program | IIJA | DOE - EERE | $1 billion | Demonstrate technologies that produce clean hydrogen using electrolyzers and validate information on the cost, efficiency, durability, and feasibility of commercial deployment. | Competitive Grants | Unknown | Program Overview<br><br>Available until expended |

| RELEVANT APPLICATIONS | PROGRAM NAME | FUNDING SOURCE | ADMINISTRATOR | TOTAL FUNDING | DESCRIPTION | FUNDING TYPE | NON-FEDERAL MATCH REQUIREMENTS | NOTES |
|---|---|---|---|---|---|---|---|---|
| **Production** | Clean Hydrogen Production Tax Credit | IRA | USDT - IRS | $0.60/kg - $3/kg | Tax credit for clean hydrogen production with 4 tiers based on lifecycle GHG emissions. | Tax Credits | None | Program Overview<br><br>Available through 2033, eligible for direct payment |
| **Production** | Investment Tax Credit | IRA | USDT - IRS | 6% base, 30% with added requirements | Tax credits for investment in clean energy technology. 10% bonuses for domestic content conditions and siting in an energy community. | Tax Credits | None | Program Overview<br><br>Available through 2033 |
| **R&D** | Department of Energy Research, Development, and Demonstration Activities | CHIPS | DOE | $11.2 billion | Support RD&D activities aligned with 10 technology areas in the energy offices (incl. hydrogen, sustainable transportation, advanced manufacturing, industrial emissions reduction, & more). | Unknown | Unknown | Program in Development<br><br>Available through 2026 |
| **R&D** | Fission for the Future | CHIPS | DOE | $800 million | Support the research, development, and demonstration of advanced nuclear reactors; specifies prioritization of H2 projects. | Competitive Grants | Unknown | Program in development |
| **R&D** | Industrial Research and Assessment Centers | IIJA | DOE - MESC | $150 million | Provide funding for institutions of higher education, community colleges, trade schools, and union training programs to identify opportunities for optimizing energy efficiency and environmental performance at manufacturing and other industrial facilities. | Cooperative agreements | Unknown | Program Overview<br><br>Available until expended |
| **R&D** | Long-Duration Energy Storage Demonstration Initiative and Joint Program | IIJA | DOE - OCED | $150 million | Establish a demonstration initiative composed of demonstration projects focused on the development of long-duration energy storage technologies. | Grant, Cooperative Agreement or Other | 50% | Program Overview<br><br>Available until expended |
| **Renewable Energy Development** | Energy Efficiency and Conservation Block Grant | IIJA | DOE - SCEP | $550 million | Includes development, implementation, and installation of fuel cells as a renewable energy technology on or in government buildings and financing for zero-emission transport/infrastructure. | Formula and Competitive Grant | None | Program Overview<br><br>Available until expended |
| **Workforce Development** | Building, Training, And Assessment Centers | IIJA | DOE - SCEP | $10 million | Grants to institutions of higher education to establish building training and assessment centers to educate and train building technicians and engineers on implementing modern building technologies. | Grants - Unknown | Unknown | Program Overview<br><br>Available until expended |

| RELEVANT APPLICATIONS | PROGRAM NAME | FUNDING SOURCE | ADMINISTRATOR | TOTAL FUNDING | DESCRIPTION | FUNDING TYPE | NON-FEDERAL MATCH REQUIREMENTS | NOTES |
|---|---|---|---|---|---|---|---|---|
| **Microgrids Critical Facilities Renewable Energy Development Production** | Greenhouse Gas Reduction Fund | IRA | EPA | $27 billion | Establishes a clean energy deployment clean bank. Includes: $7.0 billion deployment of zero-emission technologies in low income and disadvantaged communities. $11.9 billion in funds is available for grants for financial assistance and technical assistance, with $8 billion of additional funds available specifically for low-income and disadvantaged communities. | Competitive Grants | Unknown | Program Overview<br><br>Available until September 30, 2024 |
| **All** | Regional Clean Hydrogen Hubs | IIJA | DOE – OCED | $8 billion | Create networks of hydrogen producers, consumers, and local connective infrastructure to accelerate the use of hydrogen as a clean energy carrier that can deliver or store tremendous amounts of energy. | Grant, Cooperative Agreement or Other | 50% | Program Overview |


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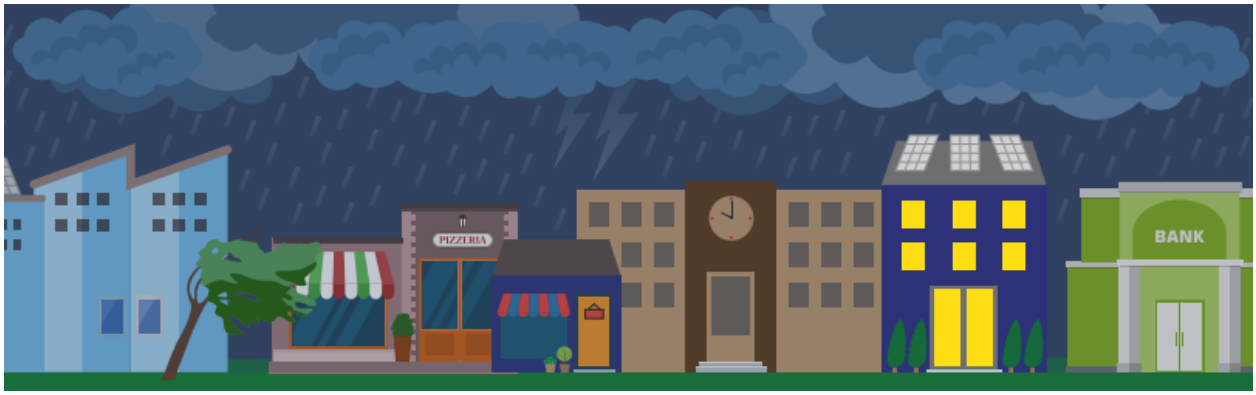



# Localizing Innovative Equitable Modern Grids

**Grid Innovation Program (40103(B))**
**Topic Area 3 – Area of Interest 2**


| **Business Point of Contact** | **Technical Point of Contact** |
|---|---|
| Sergio Carrillo<br>Connecticut Green Bank<br>Managing Director of Incentive Programs<br>sergio.carrillo@ctgreenbank.com<br>(860) 258-7826<br>75 Charter Oak Avenue<br>Suite 1-103<br>Hartford, CT 06106 | Seth Mullendore<br>Clean Energy Group<br>Executive Director<br>seth@cleanegroup.org<br>(802) 223-2554 ext. 213<br>50 State Street<br>Suite 1<br>Montpelier, VT 05602 |


**Team Member Organizations:**[1]

- **Connecticut** – Connecticut Green Bank, Public Utilities Regulatory Authority
- **Hawaii** – Hawaii Green Infrastructure Authority, Hawaii Public Utilities Commission
- **Puerto Rico** – Puerto Rico Green Energy Trust, Puerto Rico Department of Economic Development and Commerce

**Project Locations:**

- Connecticut
- Hawaii
- Puerto Rico

**Supporting Partners:**

- **Minority Serving Institutions** – University of Connecticut, University of Hawaii, University of New York at Albany
- **Management** – Clean Energy States Alliance
- **Technical Assistance** – Clean Energy Group

**Other Potential Partners:**

- **Utilities** – Luma Energy, Hawaiian Electric, Eversource Energy, United Illuminating
- **Consulting** – Elevate, Kevala

[1] It should be noted that there will likely be other team member organizations (e.g., state agencies, utilities, colleges, universities) if the Concept Paper is allowed to move forward.

## Section 1 – Introduction

Localizing Innovative Equitable Modern Grids ("the Project" or "Concept Paper") will leverage the community networks from green banks representing Connecticut, Hawaii, and Puerto Rico to demonstrate how an increase in deployment of DERs can deliver community benefit while achieving reliability, resiliency, and decarbonization goals. The Project addresses Topic Area 3 (i.e., Grid Innovation Program) and Area of Interest 2 (i.e., Distribution System Applications). The Project will address several areas prioritized in this opportunity including 1.) Transforming community resilience, including consideration of future shifts in generation and load; 2.) Catalyzing and leveraging private sector and non-federal public capital for impactful technology and infrastructure deployment; and 3.) Advancing community benefits, including workforce development and economic benefits to low income and disadvantaged communities.

Electricity customers across the United States are currently experiencing spiking electricity rates due to global energy security issues and greater challenges for grid resilience and reliability as a result of the increasingly devastating impacts of global climate change. If deployed in new ways, the suite of commercially available distributed energy resources ("DERs" – e.g., solar PV, battery storage, EV recharging stations) can offer innovative solutions to these challenges.

The Project convenes a unique collaboration of green banks representing Connecticut, Hawaii, and Puerto Rico (together the "State Partners"). The participating Green Banks (Connecticut Green Bank, Hawaii Green Infrastructure Authority, and Puerto Rico Green Energy Trust) are mission-driven, quasi-public institutions that use innovative financing to accelerate the transition to clean energy and fight climate change. This project will be supported by the Clean Energy Group and the Clean Energy States Alliance, national nonprofit leaders. Together these State Partners will seek to leverage our experience working with low-income and disadvantaged communities ("DACs") to identify and deliver new value to these communities from DERs including grid benefits.

Although geographically small, the State Partners are among the leading residential solar PV deployment states in the country in terms of watts per capita[2] – see Figures 1 and 2.

*Figure 1. "Top 10" Installed Capacity (MW) from 2018-2022*

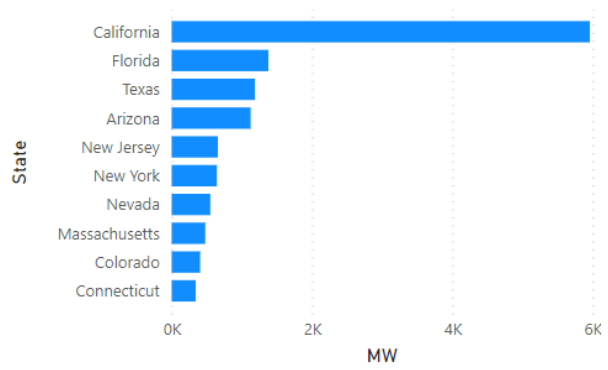
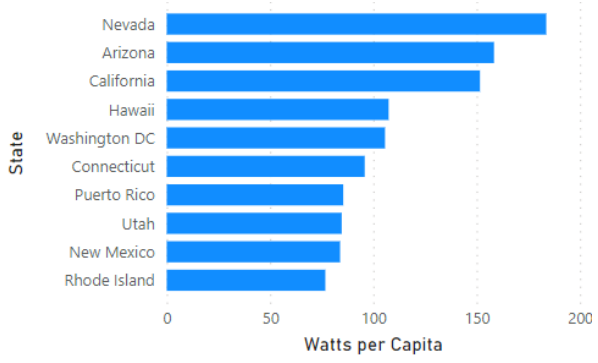



*Figure 2. "Top 10" Installed Watts per Capita from 2018-2022*




[2] "US Solar Market Insight – Q4 2022" by SEIA and Wood Mackenzie (December 2022)

Hawaii has the highest penetration rate of residential solar PV in the country at 32% with Connecticut at 8% and Puerto Rico at 6%. Compared to other U.S. States, a higher percentage of residential solar PV systems in Hawaii and Puerto Rico are paired with battery storage, which ensures a clean, reliable, and resilient energy supply. Each State Partner in this Project has experience supporting the deployment of this clean energy technology into low-income and underserved communities. With this Project, we seek to demonstrate and quantify the hidden and underutilized value of DERs, which will be further used to inform new technology deployment strategies to achieve lower barriers to adoption of technology to deliver community benefit.

The State Partners each face similar, but distinct grid challenges that could be addressed through innovative deployment of DERs with supportive financing provided by green banks. Specifically, the Project will have the following three (3) objectives:

1. **Address Grid Challenges:**

    a) **Ensure Reliable Grid Operations** – a focus for Hawaii in displacing fossil fuel fired powered plants with battery storage and solar PV as it plays a key role in grid reliability;

    b) **Improve Overall Grid Resilience**[3] – a focus for Puerto Rico in installing solar PV and battery storage makes the electric distribution system much more resilient to extreme weather and system-wide outages; and[4]

    c) **Decarbonize Electricity and Energy System** – a focus for Connecticut in identifying and prioritizing deployment of battery storage in high-emission regions, especially vulnerable communities,[5,6] is a priority for managed charging and discharging of battery storage.[7,8]

2. **Innovative Collaboration** – the State Partners have public policies reflecting decarbonization for their electricity sector and quasi-public green banks focused on mobilizing private investment in the deployment of DERs for families and businesses, especially those in vulnerable communities – they will collaborate to support each other

[3] "Resilience" means the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from deliberate attacks, accidents or naturally occurring threats or incidents, including, but not limited to, threats or incidents associated with the impacts of climate change.

[4] "Distributed rooftop solar and battery storage will ensure reliable and affordably electricity for all Puerto Ricans" by Earth Justice (October 7, 2022)

[5] As defined by Public Act 20-05, "vulnerable communities" means populations that may be disproportionately impacted by the effects of climate change, including, but not limited to, low and moderate income communities, environmental justice communities pursuant to section 22a-20a, communities eligible for community reinvestment pursuant to section 36a-30 and the Community Reinvestment Act of 1977, 12 USC 2901 et seq., as amended from time to time, populations with increased risk and limited means to adapt to the effects of climate change, or as further defined by the Department of Energy and Environmental Protection in consultation with community representatives.

[6] Vulnerable communities may be used interchangeably with low-income and disadvantaged communities

[7] Docket No. 22-08-05 – Annual Energy Storage Solutions Program Review – Year 2 (December 21, 2022)

[8] Integrated Resources Plan of the Connecticut Department of Energy and Environmental Protection (October 2021) (p.13)

in advancing DER interconnection and deployment towards local community benefit realization.

3. **Deliver Economic Benefits and Improve Cost-Effectiveness** – the deployment of DERs provide economic benefits to participants and improved cost-effectiveness to ratepayers. The State Partners have some of the highest residential electricity rates in the United States, making this a priority interest for the State Partners.

## Section 2 – Project and Technology Description

The team proposes the following three (3) components of the Project:

1. **Planning** – based on the lessons learned from the DOE's Communities Local Energy Action Plan ("Communities LEAP") pilot program,[9] the State Partners will each develop model Community Benefit Agreements ("CBA") with a focus on DER interconnection and deployment in households and resilience hubs[10] in low-income and disadvantaged communities ("DAC"). We will seek to build on the previous knowledge generated through the Communities LEAP collaboration with NREL to generate actionable impact at the community level.

2. **Deployment** – to realize community resilience and grid benefits, the Project must increase and accelerate the deployment of DERs, which includes the following components:

    a. **Contractor Recruitment** – based on CBA-defined qualification requirements for DER-installation contractors;

    b. **Customer Acquisition** – based on CBA-defined approaches for community engagement, including community-based marketing campaigns (e.g., Solarize, Weatherize, Ruggedize) to generate DER demand; and

    c. **Funding and Financing** – leveraging green bank experience to develop incentive and financing packages specific to low-income and DACs from both state and federal sources, including tax credits and incentives through the Inflation Reduction Act ("IRA"), and financing, as well as private capital, as sources of capital for participants and match for the Project.

3. **Demonstration** – DER control and optimization (e.g., passive and active dispatch, managed charging and discharging, outage mitigation) to demonstrate measurable community resilience and grid benefits, such as improved reliability and resilience (e.g., reduced outage time for communities, energy efficiency improvement), carbon emissions reduction, and beneficial electrification.

The three key Project components are detailed below in Figure 3.

[9] https://www.energy.gov/communitiesLEAP/communities-leap

[10] "Resilience Hubs" are community-serving facilities augmented to support residents, coordinate communication, distribute resources, and reduce carbon pollution while enhancing quality of life. Hubs provide an opportunity to effectively work at the nexus of community resilience, emergency management, climate change mitigation, and social equity while providing opportunities for communities to become more self-determining, socially connected, and successful before, during, and after disruptions.

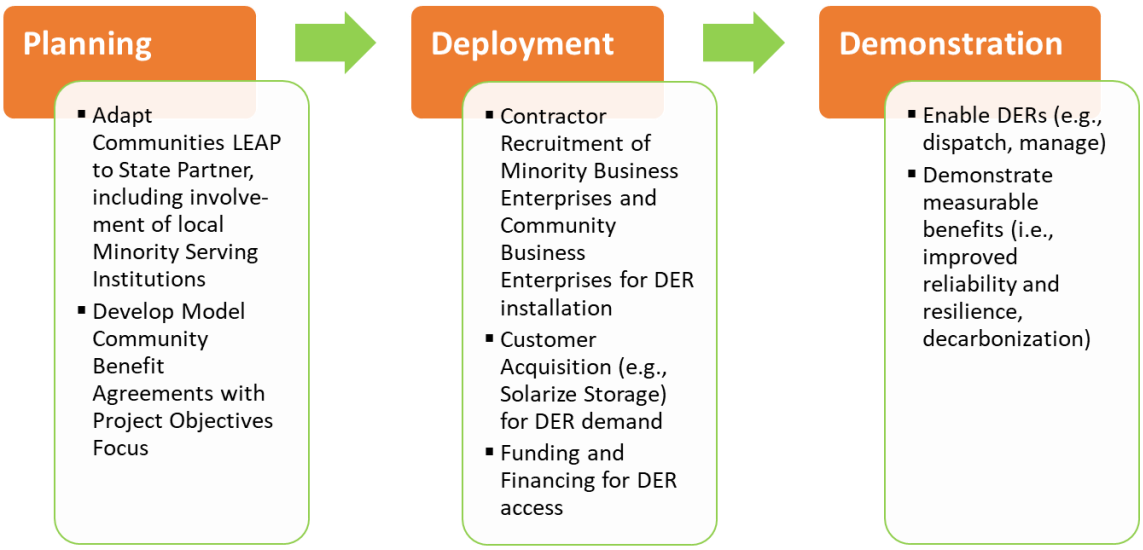



*Figure 3. Components of the Project*

**Section 2.1 Eligible Uses and Technical Approaches**

The Project seeks to demonstrate how the interconnection and integration of variable DERs such as solar PV, battery storage, beneficial electrification, and EV rechargers within the distribution system, especially in vulnerable communities, can deliver community benefit and address reliability, resiliency, and decarbonization grid challenges. The Project will focus on the deployment of DERs in low-income and DACs, and specifically residential end-use customers (i.e., single-family and multifamily; owned or rented housing units) and community resilience hubs.

The Project will demonstrate, but not be limited to the following:

- Adaptative microgrid formation, reliable islanded operations, and utilization of DERs to provide back-up power and enhance grid resilience.
- Reliable and resilient system operations utilizing high levels of DERs.
- Behind the meter asset operations, aggregation, and coordination to provide demand response ("DR") and grid services.

The Project will offer the greatest public benefits to participating low-income and DACs by deploying DERs for their residents and in resilience hubs serving these communities. The team will ensure that there is a clear pathway to replicability and scalability across multiple communities from knowledge sharing between the State Partners.

**Section 2.2 State Resilience in Reducing Consequences of Disruptive Events, Decarbonization, or Other Energy Strategies or Plans**

The Project supports each of the State Partner's efforts to improve reliability and resiliency of the grid and to decarbonize electricity and energy systems through the deployment of DERs, especially in vulnerable communities. The deployment of DERs will reduce the likelihood of

disruptive events resulting from climate change through increased resilience, while also reduce greenhouse gas emissions that contribute to global climate change – see Table 1.

*Table 1. Examples of Disruptive Events and Decarbonization Policies in Partner States*

| Partner State | Disruptive Events | Decarbonization Policies |
|---|---|---|
| Connecticut | Tropical Storm Isaias in 2020 brought down power lines causing 800,000 customers to lose power. Public Act 20-05, colloquially known as the "Take Back Our Grid Act" established a regulatory framework for performance-based regulation, created a microgrid and resilience grant program, and defined resilience and vulnerable communities. | Public Act 18- 82 "An Act Concerning Climate Change Planning and Resiliency," established a 45% reduction of 2001 level target for GHG emissions.<br><br>Public Act 21-53 "An Act Concerning Energy Storage," established a 1000 MW target by 2030.<br><br>Public Act 22-5 "An Act Concerning Climate Change Mitigation," established a 100% zero carbon electric sector by 2040. |
| Hawaii | Hawaii is vulnerable to natural disasters such as flooding, hurricanes, tsunamis, lava flows and earthquakes, as demonstrated by the following headlines: "*Hawaii winter storm: thunder, hail and power outages*" (12/20/22); "*Hawaii Storm Ravages Islands Leaving Thousands Without Power*" (12/8/21); "*Magnitude 6.9 earthquake hits Hawaii, leaving thousands without power one day after volcanic eruption*" (5/4/18); and "*Hurricane disrupts power on Hawaii's Big Island*" (8/8/14). | 269-92, HRS, "Related to Renewable Portfolio Standards," established a 100% renewable portfolio standard in the electricity sector by 2045.<br><br>225P-5, HRS, "Zero Emissions Clean Economy Target," statewide target to sequester more atmospheric carbon and greenhouse gases than emitted as quickly as practicable, but no later than 2045.<br><br>196-10.5, Hawaii Revised Statutes (HRS) "Hawaii Clean Energy Initiative Program," established a framework of statutes and regulations committed to Hawaii's clean energy future. |
| Puerto Rico | Hurricane Maria ("H-Maria") damaged more than 55% of Puerto Rico's transmission towers, leaving a significant portion of the island's 2,400 miles of transmission and 30,000 miles of distribution lines | As a result of H-Maria, Puerto Rico re-envisioned the energy industry by creating the Puerto Rico Energy Bureau (PREB) as an independent and specialized body created by Act 57-2014, as amended, to serve as key component for the full and transparent implementation of the Energy Reform. |

| | | |
|---|---|---|
| | nonfunctional for months[11]. This power loss was accompanied by considerable damage to the economy and human hardship. The damage occasioned by H-Maria is considered the largest in US History[12]. More recently, Category-1 Hurricane Fiona caused relatively minor long-term damage, however, short term left the Island without power for weeks. | Specifically, the PREB has the responsibility to regulate, monitor and enforce the energy public policy of the Government of Puerto Rico.<br><br>PREB executes policies to facilitate and implement the Integrated Resource Energy Plan with specific target goals of achieving 100% renewables energy generation by 2050. |

The Project Manager will support the State Partners in identifying best practices in public policy and regulation through the implementation of the Project that catalyze markets for private investment.

**Section 2.3 Grid-Benefitting Outcomes**

As a result of the successful implementation of the Project, the following grid-benefitting outcomes are expected:

- **Advancement of Grid Services** – DER incentive programs, such as Energy Storage Solutions in Connecticut and Battery Bonus in Hawaii, essentially enable the operation of dispatchable virtual power plants ("VPP"), thereby increasing resilience to participants, reducing electricity rates for ratepayers (i.e., by reducing peak demand through passive and active dispatch), and increasing reliability and decarbonization for society (e.g., addressing local grid constraints and real-time emissions mitigation). The team will work with leading DER technology vendors, utilities, and local Minority Supporting Institutions ("MSI") within their respective states, to identify how DER deployment can value stack grid benefits to provide advanced functionality. This may also include the demonstration of non-wires solutions of the distribution system, which can result in the deferral of costly grid upgrades.

- **Improvement in Cost-Benefit Testing** – conservation, load management, and clean energy programs administered by states and/or their utilities rely on standard definitions of costs and benefits to evaluate the cost-effectiveness of energy programs (e.g., performance-based incentives). However, these frameworks have a limited language, largely defined based on impacts to the wholesale market. As part of this project, the team will seek to solicit input from local communities around what benefits are of highest priority to community members (e.g., workforce development, air quality, resilience during outages, etc.) and provide recommendations on how these benefits can be valued in program design and analysis to unlock market-based mechanisms (e.g., performance-based incentives) to catalyze private investment.

[11] Hurricane Maria Effects on Puerto Rico Electric Power Infrastructure (Journal Article) | NSF PAGES
[12] The World's Second Largest Blackout | Rhodium Group (rhg.com)

- **Enable Financial Innovation for Vulnerable Communities** – providing upfront and ongoing performance-based incentives that deliver grid services and measurable benefits, can unlock new models for financial innovation, especially for low-income and DACs. For example, through the Residential Renewable Energy Solutions and Energy Storage Solutions incentive programs in Connecticut and Battery Bonus program in Hawaii, incentives resulting from the deployment and performance of technologies (i.e., kWh produced from solar PV, kWh of power dispatched from battery storage) can partially or wholly be directed to a third-party financier as a source of revenue to finance the project – essentially eliminating the need to underwrite transactions to the credit quality of the DER host. By turning non-traditional value streams such as grid services and performance-based incentives into revenue sources for projects, then innovative financial vehicles can be created to accelerate the deployment of DERs in low income and DACs.

These are a few of the grid-benefitting outcomes from the Project.

**Section 2.4 Impact of the Project – Reduce Innovative Technology Risk, Achieve Further Deployment At-Scale, and Lead to Additional Private Sector Investments**

The Project seeks to accelerate and demonstrate the interconnection and deployment of DERs to unlock their associated benefits for low income and DACs by leveraging limited federal funding sources to mobilize private investment. Private sector investment will be required to achieve the scale of deployment needed to decarbonize and increase resilience against climate change. Leveraging public funds to mobilize private investment in DERs in vulnerable communities is a fundamental principle of green banks. Green banks are known for advancing innovative financing of DERs,[13] especially for vulnerable communities,[14] and will bring this expertise to the team.

The impacts from successfully implementing the Project, include (at a minimum):

1. **Planning** – during the Planning and CBA development stage, the team will develop:

    a. **Community Benefits Definitions** – development of community-led definition of the benefits resulting from the deployment of DERs

    b. **Resilience Differentiation** – ability for the local community to differentiate between blue-sky, gray-sky (i.e., relatively frequent storms), and dark-sky (i.e., relatively rate and devastating storms) conditions to increase resilience

2. **Deployment** – during the Deployment stage, the team will support:

[13] "Long-Term Performance of Energy Efficiency Loan Portfolios" by Jeff Deason, Greg Leventis, and Sean Murphy of Lawrence Berkeley National Labs (March 2022)

[14] "Performance of Solar Leasing for Low- and Moderate-Income Customers in Connecticut" by Jeff Deason, Greg Leventis, and Sean Murphy of Lawrence Berkeley National Labs (May 2021)

a. **Mobilize Private Investment** – demonstrate the financeability of these projects to drive additional private sector investment through financial innovation, including:

   i. implementing "pay for performance" models
   ii. developing a scalable financing solution for DERs for tenants and landlords
   iii. investigating how customer charging and consumption behavior can shift using prepaying/budgeting rather than post-paying for energy use

b. **Accelerate Solar + Storage Adoption** – increased community engagement, including financial and energy literacy education, will accelerate solar + storage adoption within disadvantaged communities.

3. **Demonstration** – during the Demonstration stage, the team will demonstrate:

   a. **Grid Services** – demonstrate functionality of DERs and quantify the benefit of grid services including:

      i. power for critical loads during an outage
      ii. peak demand shaving
      iii. frequency and voltage regulation
      iv. reducing DER curtailment
      v. reducing grid outage time (i.e., improving grid restoration speed)
      vi. ramping/spinning reserves
      vii. providing real time emissions mitigation displacing fossil fuel power plants
      viii. addressing local grid constraints through granular VPP-style deployments with active and passive management of DERs

   b. **Decrease system cost** – with bulk purchasing to increase economic benefits to disadvantaged ratepayers.

**Section 2.5 Impact of DOE Funding**

The funding from the DOE would allow the State Partners to:

- **Adapt and Scale Community Engagement Program** – understanding the best practices from Communities LEAP will enable the State Partners to adapt and scale-up community engagement that will lead to the development of model CBAs, including technical assistance transfer from DOE (e.g., National Renewable Energy Laboratory – "NREL")[15]

[15] Consideration will be given to include Argonne National Laboratory as well given their Center for Climate Resilience and Decision Science

to local Minority Serving Institutions ("MSI") partnerships (e.g., University of Connecticut);[16]

- **Support Diverse Businesses and Workforce Development** – develop processes and procedures to identify and source work from Minority Business Enterprises ("MBE") or Community Business Enterprises ("CBE"), while seeking to increase the diversity of the workforce through CBAs;

- **Support Sustainable Job Creation** – establish sustainable job creation requirements for participants through the CBA, support the retraining and upskilling of second-chance job seekers, and collaborate with credential programs to support DER-deployment careers;

- **Initiate Inclusive Community-Based Marketing Campaigns** – implement and adapt customer acquisition strategies like Solarize that have demonstrated the ability to increase and accelerate demand for DERs with a focus on low income and DACs;

- **Ensure Equitable Access to Funding and Financing** – provide household and community resilience hub participants with grant funding, including for labor and equipment where appropriate (i.e., Puerto Rico), and easy and affordable access to financing to provide the capital necessary to deploy DERs in low income and DACs; and

- **Realize Benefits through Innovative Local Modern Grids** – provide additional technical assistance to enable DERs to deliver measurable benefits to participants, ratepayers, and society.

**Section 2.6 Readiness, Viability, and Expected Timing of Project**

The three-year Project could start as soon as an award announcement was made, with the first 6 months being contract finalization (i.e., 14 quarters in total).

Based on the components of the Project, the following would be an anticipated timeline – see Table 2:

- **Contracting** – once the DOE announced that the Project was among the awardees, then the Applicant would begin to draft and finalize contracts with State Partners and Project Manager, as well as, if appropriate, contracts with Team Member Organizations and Other Potential Partners. The Applicant suspects that this will take 3-6 months (i.e., Q1-Q2).

- **Planning** – once the contracts for the Project are in place, then the focus will be to adapt Communities LEAP and develop a model CBA for the State Partners. The Applicant suspects that this process will take a year (i.e., Q3-Q6), with several "touch points" along the way to share "lessons learned" and "best practices" (i.e., Q8 and Q12), transfer technical assistance skills from federal laboratories to local MSIs (i.e., Q9 and

[16] UCONN and NREL Announce Partnership for Research and Innovation (October 20, 2022) – click here

Q13), as well as modify the CBA as appropriate with the State Partners (i.e., Q9 and Q13).

- **Deployment** – once the model CBA is ready, then continuous recruitment of MSEs and CSEs (i.e., every 6 months of each year),[17] launching ongoing community-based marketing campaigns, and initiating funding and financing programs to deploy DERs in low income and DACs will ensue for the entirety of the Project.

- **Demonstration** – after a year of deployment, the enablement of DERs will continuously ensue across a myriad of grid services, and the measurement of benefits will be done every 6 months through the end of the project.

*Table 2. Project Timeline*

| Quarter | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Contracting** | | | | | | | | | | | | | | |
| a) State Partners and Project Manager | x | | | | | | | | | | | | | |
| b) Team Member Organizations | x | x | | | | | | | | | | | | |
| c) Other Potential Partners | x | x | | | | | | | | | | | | |
| **Planning** | | | | | | | | | | | | | | |
| a) Adapt Communities LEAP | | | x | x | x | x | | x | x | | | x | x | |
| b) Develop Model CBA | | | | | | x | | | x | | | | x | |
| **Deployment** | | | | | | | | | | | | | | |
| a) Contractor Recruitment | | x | x | | x | x | | x | x | | x | x | | |
| b) Customer Acquisition | | | | x | x | x | x | x | x | x | x | x | x | x |
| c) Funding and Financing | | x | x | x | x | x | x | x | x | x | x | x | x | x |
| **Demonstration** | | | | | | | | | | | | | | |
| a) Enable DERs | | | | | | | x | x | x | x | x | x | x | x |
| b) Demonstrate Measurable Benefits | | | | | | x | | x | | x | | x | | x |

Match funding may be difficult to source, but the State Partners will seek to work together to assemble a proposal that equitably and appropriately distributes match funding, including leveraging private capital as match.

[17] https://www.eventbrite.com/e/2023-mbe-doe-connect-virtual-summit-tickets-479261452907

## Section 3 – Community Benefits Plan

The Project will build on the lessons learned from the DOE's Communities LEAP pilot program to facilitate sustained community-wide economic and environmental benefits through the deployment of DERs. Bridgeport, Connecticut was among the 24 selected communities within Communities LEAP.[18] Through the leadership of the Greater Bridgeport Community Enterprises, and with support from Operation Fuel and the Connecticut Green Bank, Bridgeport, was awarded technical assistance from NREL and Elevate for community planning.

With this support, Bridgeport will develop: 1.) stakeholder mapping and community outreach tools, 2.) communications templates, 3.) model community benefits agreement, 4.) a community-driven project to address energy or environmental injustice, 5.) project screening criteria and project implementation standards, 6.) a review of existing policies and incentives, 7.) capacity and gaps assessment, 8.) a community energy profile, and 9.) renewable energy technology workshops.

The team will leverage the lessons learned through Bridgeport's involvement in Communities LEAP to develop template tools that can be used in other low-income and DACs. The State Partners will each identify their "Top 5" low-income and DACs[19] to provide technical assistance adapted from Communities LEAP with a focus on the deployment of DERs.

### Section 3.1 Community and Labor Engagement Leading to Negotiated Agreements

The team will develop model CBAs (i.e., Task 2), with the following policy priorities of the Justice 40 Initiative (i.e., consistent with and additive to the Project's objectives):

1. Decrease energy burden in DACs (i.e., target less than 6% energy burden)
2. Decrease environmental exposure and burden in DACs
3. Increase parity in DER access and adoption in DACs (i.e., at least proportional adoption within communities of color)
4. Increase access to low-cost capital in DACs
5. Increase enterprise creation and contracting for MBEs or CBEs in DACs
6. Increase clean energy jobs, job pipeline, and job training for individuals from DACs
7. Increase energy resilience in DACs
8. Increase energy democracy in DACs

The CBA would express commitment towards these policy priorities, with an emphasis on contractor recruitment for priorities 5 and 6, while ensuring access to apprenticeship programs and prevailing wages.

### Section 3.2 Investing in Job Quality and Workforce Continuity

In 2021, the U.S. energy sector jobs grew by 4.0% adding more than 300,000 jobs over 2020 to 7.8 million jobs in 2021 – outpacing overall U.S. employment, which climbed by 2.8% during the

[18] https://www.energy.gov/articles/doe-will-assist-24-communities-locally-tailored-pathways-clean-energy
[19] As identified by the DOE's Justice 40 Initiative – https://www.energy.gov/diversity/justice40-initiative

same period. In 2021, renewable energy jobs grew while fossil energy jobs decreased – jobs in net-zero emissions aligned areas made up approximately 40% of total energy jobs

The importance of a model CBA cannot be understated. Ensuring a "just transition" requires that the Project foster the sustained orderly development of a diverse and local DER industry, as included within Connecticut policy.[20]

Supporting and replicating workforce development programs, such as the Makaha Learning Center ("Center"), will be a focus for cross-state knowledge building and transfer will be a focus of the State Partners. The Center is a Native Hawaiian organization specializing in trade education programs in renewable energy, construction, and electrical work, to break the cycle of poverty for Native Hawaiians and residents of the Waianae, an area where Pacific Islander population and low-Income households are overrepresented. Due to its impact and track record, in July 2022, the Center received part of $3 million in federal funding from the Biden Administration's Justice40 Initiative,[21] and in January 2023, the Center was named one of Stanley Black & Decker's Makers Grant awardees, sharing a portion of a $25 million award to support workforce development in construction and manufacturing.[22] It should be noted that Stanley Black & Decker is headquartered in New Britain, Connecticut.

The Project presents a timely opportunity to meet the growing demand for workers in the clean energy sector in Connecticut, Hawaii and Puerto Rico, in a way that uplifts marginalized communities.

**Section 3.3 Advancing Diversity, Equity, Inclusion, and Accessibility**

Advancing diversity, equity, inclusion, and accessibility in the clean energy economy is an imperative for the Project. Diversity in the clean energy workforce varies from state to state – see Table 4.[23]

*Table 3. Diversity of US Workforce, including Energy by Connecticut and Hawaii in 2021[24]*

| Diversity Metrics | United States Average | United States Energy | Connecticut | Hawaii |
|---|---|---|---|---|
| Female | 47% | 25% | 26.5% | 28.6% |
| Hispanic or Latino | 18% | 17% | 16.8% | 19.6% |
| Black or African American | 12% | 8% | 8.6% | 7.7% |
| Pacific Islander/Native Hawaiian | <1% | 1% | 0.8% | 9.5% |
| Veteran | 6% | 9% | 6.9% | 7.1% |
| 55 and Over | 24% | 17% | 11.2% | 10.6% |
| Disability | 4% | 2% | 2.1% | 1.9% |

[20] Public Act 21-43 "An Act Concerning a Just Transition to Climate-Protective Energy Production and Community" and Public Act 21-53 "An Act Concerning Energy Storage"

[21] The 2021 Justice 40 Accelerator Cohort Won $3M in Federal Funding (makahalearning.org)

[22] Mākaha Learning Center named Stanley Black & Decker Makers Grant Recipient | KHON2

[23] United States Energy and Employment Report 2022 by the USDOE (June 2022)

[24] Data on territories (e.g., Puerto Rico) not available

| | | | | |
|---|---|---|---|---|
| Formerly Incarcerated | 2% | 1% | 1.3% | 0.9% |

Supporting the transition of technical assistance and community engagement to local Asian American and Native American Pacific Islander Serving Institutions (e.g., University of Connecticut, University of Hawaii) and Hispanic Serving Institutions (e.g., University of Puerto Rico-Mayaguez), as well as community colleges and trade schools, will increase diversity, equity, inclusion, and accessibility for the future clean energy workforce. And providing equitable access to MBEs and CBEs to lead the work, will increase wealth and increase access to a more diverse clean energy industry.

**Section 3.4 Contributing to the Justice40 Initiative**

As noted throughout the Concept Paper, the Project is solely focused on community resilience and transformation with a focus on (1) the objectives consistent with the Grid Innovation Program, and (2) DER deployment in and benefits to low income and DACs consistent with the Justice 40 Initiative.

The Energy Equity Hui[25] is a group of energy stakeholders and interested community members throughout the State of Hawaii committed to ensuring the transition to clean and efficient energy is accessible, beneficial, and respectful of socioeconomically disadvantaged communities, and includes equitable and sustainable business and workforce development. The Hawaii Green Infrastructure Authority, Hawaiian Electric, and the Hawaii Public Utilities Commission are members of the Hui and are committed to its mission of an equitable energy future in the state.[26]

In Connecticut, the Governor's Council on Climate Change recommended that no less than 40 percent funding for equity and/or community benefit be directed at vulnerable communities disproportionately impacted by the effects of climate change.[27] The Connecticut Department of Energy and Environmental Protection, in collaboration with the Connecticut Institute for Resilience and Climate Adaptation at the University of Connecticut, oversee a Climate & Equity Grant Program to provide community-based organizations aligned with environmental justice, climate change adaptation, and mitigation across the state with funding support. And, the Connecticut Green Bank adopted the Justice 40 recommendation within its Comprehensive Plan.

[25] *Hui* means group or partnership in Hawaiian.

[26] Energy Equity Hui - Blue Planet - We are 100

[27] "Taking Action on Climate Change and Building a More Resilient Connecticut for All" by the Governor's Council on Climate Change (January 2021) (p.50)

# Section 4 – Addendum A

### Section 4.1 Project Manager and Project Team Skills and Expertise

**The Clean Energy States Alliance** ("CESA") will be the Project Manager. CESA is a leading bipartisan US coalition of state energy agencies working together to advance the rapid expansion of clean energy technologies and bring the benefits of clean energy to all. CESA's members include many of the nation's most innovative, successful, and influential implementers of clean energy policies. CESA facilitates the expansion of state clean energy policies, programs, and innovation, with an emphasis on renewable energy, energy storage, energy equity, and resiliency.

**The Clean Energy Group** ("CEG") will provide technical support to the Project. CEG is a national nonprofit organization that works at the forefront of clean energy innovation to enable a just energy transition to address the urgency of the climate crisis. CEG collaborates with partners across the private, public, and nonprofit sectors to accelerate the equitable deployment of clean energy technologies and the development of inclusive clean energy programs, policies, and finance tools.

**The Connecticut Green Bank** is the nation's first green bank and was established by the Connecticut General Assembly in July 2011. The Connecticut Green Bank supports the Governor's and Legislature's energy strategy to achieve cleaner, less expensive, and more reliable sources of energy while creating jobs and supporting local economic development. In 2021, the Green Bank's model was expanded to include new areas of environmental infrastructure, related to climate adaptation and resiliency, land conservation, parks and recreation, agriculture, water, waste and recycling, and environmental markets, including carbon offsets and ecosystem services.

**The Hawaii Green Infrastructure Authority** (HGIA) was constituted in November 2014 to democratize clean energy by making clean energy improvements affordable and accesible to broader strata of Hawaii's rate payers to advance the State's goal of a 100 percent renewable portfolio standard in the energy sector by 2045. HGIA administers non-traditional financing programs that fill market gaps, stimulate private investments, and expand access to capital. In 2019, HGIA strengthened its commitment to underserved ratepayers by limiting the use of its Green Energy Market Securitization (GEMS) loan capital to LMI homeowners and renters, nonprofits,small businesses, and multi-family rental projects. HGIA also offers financing to state departments, conducts work in promoting energy equity through community engagement and adminsters the State Small Business Credit Initiative (SSBCI) HI-CAP Collateral Support, CDFI Loan Pool and Loans Programs.[28]

[28] 2022 Hawaii Green Infrastructure Authority Annual Report to the Governor and Legislature

**The Puerto Rico Green Energy Trust** was established in 2019 and seeks to financially support projects that provide access to green energy to residents of low and middle-income communities, as well as promote the strengthening of the culture of saving and efficient use of energy, among others.

These lead applicants are supported by a consortium of state energy regulators, utilities, local minority serving institutions, and community partners including local universities.

**Section 4.2 Prior Experience of the Team**

Many of CESA's prior experiences demonstrate the ability to perform tasks of similar risk and complexity to the Project, including **managing state-focused learning exchanges** – CESA provides peer-to-peer opportunities for state clean energy program managers to 1) share information and identify best practices; 2) engage in joint efforts to create and advance successful policies and programs; and 3) contribute to and gain the collective insights of colleagues across the country who are striving to turn zero-carbon and energy equity goals into reality.

CEG has provided technical expertise to similar project such as the **Resilient Power Project** – which has advanced the deployment of resilient, clean energy solutions – primarily solar PV paired with energy storage ("solar + storage") – in critical community facilities serving environmental justice communities, low-income communities, and communities of color. The project's goal is to advance clean energy equity and build energy security by ensuring that all communities have access to the economic, health, and resilience benefits that solar + storage technologies can provide.

Since its inception, the Connecticut Green Bank has mobilized $2.26 billion of investment into Connecticut's clean energy economy at a 7 to 1 leverage ratio of private to public funds. The Green Bank has supported the creation of 27,720 direct, indirect and induced jobs, reduced the energy burden on over 66,500 families and businesses, deployed nearly 510 MW of clean renewable energy, helped avoid 10.4 million tons of CO2 emissions over the life of the projects, and generated $113.6 million in individual income, corporate, and sales tax revenues to the State of Connecticut. Our **Residential Solar Investment Program** has enabled the deployment of more than 46,000 residential rooftop solar PV systems in the state, with 42% of these systems located in low-and-moderate income households and disadvantage communities.

Since its inception in September 2022, the Hawaii Green Infrastructure Authority has facilitated over $130.0 million in clean energy investments throughout the state, including Solar Photovoltaic Systems, Energy Storage Systems, Lighting Upgrades, and HVAC Upgrades. Lifetime estimates of greenhouse gas avoided aggregate 282,225 metric tons. Economic development impacts include over $16.4 million of state tax revenues generated, a multiplier impact of $276.8 million and over 1,300 jobs created/retained.

The Puerto Rico Green Energy Trust is among the newest state-level green banks in the country. As it continues to develop, the market for residential solar PV and battery storage in Puerto

Rico is the fastest growing market in the United States. There have been nearly 69,000 residential solar PV installations, many of them including battery storage, installed in Puerto Rico totaling over 420 MW.

Among our supporting partners, the University of Connecticut is host to the **Eversource Energy Center[29] ("EEC")**, which is an interdisciplinary center focused on power system operations, operational outage prediction systems at several utilities, solar PV grid integrations, and field grid operations. EEC has secured more than $50M in funding from the power industry and federal government (DOE, NSF, NASA, NOAA), including a recently selected project by DOE Renewables Advancing Community Energy Resilience (RACER) program, to develop new technologies and science-based solutions for the distribution of reliable power and the management of risks associated with extreme weather and security events. The University of Connecticut's **Human Rights Institute** ("HRI") is a globally recognized leader in human rights research and in research, teaching, and translational policy efforts on environmental sustainability. HRI is committed to promoting the economic rights of people in marginalized communities and to forging environmental justice through partnerships and hands-on research experience involving students, faculty, alumni, and supporters in government, industry, and nongovernmental organizations globally.

The University of Hawaii System has a robust offering of opportunities in training, research, and coursework relating to grid integration, sustainable power generation, and energy efficiency. The University of Hawaii at Manoa has a Renewable Energy and Island Sustainability program which consists of coursework and research experience in clean energy, renewable energy production, energy storage, integration, and smart grids. In 2010, the program received a $2.5 million grant from the Department of Energy to train engineers in the field of clean energy technology.[30] The **Hawaii Natural Energy Institute**, also at the Unviersity of Hawaii at Manoa, conducts research, development, testing, and evaluation of utility grids, including smart and micro grid systems.[31] In August 2022, the University of Hawaii's seven Community Colleges were collective awarded $16.4 million from the US Department of Commerce to establish a sustainable workforce through the "**Resilient Hawaii**" initiative. One of four target sectors is clean energy, and the initiative is focused on equitable participation by Native Hawaiian and Pacific Islander Communities. The initiative aims at training 3,000 participants, and joins community college resources with 70 employers, training providers, and community organizations.[32] All of the University of Hawaii System's ten member campuses are recognized as Asian American and Native American Pacific Islander Serving Institutions by the US Department of Education.[33]

[29] eversource.uconn.edu

[30] Mānoa: College of Engineering awarded $2.5 million to develop clean energy program | University of Hawaii News

[31] Grid Integration & Renewable Power Generation - Hawai'i Natural Energy Institute (HNEI) (hawaii.edu)

[32] UH earns $16M federal grant to assist in sustainable workforce development | University of Hawai'i System News (hawaii.edu)

[33] Program serving Asian, Native Americans, Pacific Islanders celebrates milestone | University of Hawai'i System News (hawaii.edu)

**Section 4.3 Applicant and Partners Prior History**

CEG and CESA have worked together with the Connecticut Green Bank, including the following projects:

- **Scaling Up Solar for Under-Resourced Communities** – a project supported by the DOE, it focuses on accelerating the development of solar projects for three distinct subsets of the LMI solar market: single-family homes, manufactured homes, and community institutions, including multifamily affordable housing. For the single-family homes sector, the project promotes the successful initiative that has brought solar to 3,000 LMI homeowners in Connecticut from 2015 to 2021, growing by 320% over the duration of the program, and encouraging and supporting other states to adapt it to their markets.

- **Solar with Justice: Connecting States and Communities** – working with state energy agencies and community-based organizations in under-resourced communities so that they are better able to share the knowledge and information that is needed for solar to be developed efficiently, equitably, and cost-effectively in LMI communities. The project aims to create opportunities for state energy agencies to better understand the perspectives of community-based organization leaders in LMI communities, to identify and address solar information gaps, and to involve these organizations in solar initiatives.

- **Climate Smart Technology and Home Medical Devices for Affordable Housing** – affordable housing residents who are electricity-dependent for Home Medical Devices ("HMD"), including, but not limited to oxygen concentrators, ventilators, infusion and intravenous equipment, nebulizer and sleep apnea devices, are unable to shelter in place and must turn to hospitals to charge their devices. To understand the investment needed in Climate Smart Technologies ("CST") (i.e., DERs), the project seeks to understand how to increase resilience through CST deployment of people requiring HMDs, and to also realize opportunities for enabling investment in CSTs at affordable housing properties.

And CESA has also worked with the Hawaii Green Infrastructure Authority on the following initiatives:

- **GEM$ Energy Services Program Launch** – similar to a solar lease or solar power purchase agreement, the Green Energy Money $aver (GEM$) Energy Service Program provides low and moderate-income (LMI) homeowners and renters an opportunity to lower their energy burden with no upfront costs.

- **Solarize808 Waianae and Koʻolauloa** – a community-based, solar PV group purchasing campaign scheduled to launch in April 2023.

It should be noted that while CEG and CESA have both worked with partners in Puerto Rico, the organizations have not collaborated directly with the Puerto Rico Green Energy Trust. If the Project is supported by the DOE, Puerto Rico Green Energy Trust will be invited to join CESA.

Each of the green banks involved in the Project are also members of the American Green Bank Consortium.

**Section 4.4 Applicant Access to Equipment and Facilities**

As the Project relies on commercially available technology, the Team has sufficient access to technology, and foresees no concerns in recruiting technology partners to support the specific use cases detailed in this Concept Paper. The Team has sufficient access to our target customers and will work through our respective local engagement organizations to build out community engagement initiatives.

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