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Joint Committee of the CT EE Board & CGB Board of Directors

Meeting Date

December 16, 2020

JOINT CGB/EEB COMMITTEE MEMBERS

Eric Brown Chair CT Business & Industry Association	**Michael Li** CT Department of Energy and Environmental Protection (DEEP)
John Harrity Chair CT Roundtable on Climate and Jobs	**John Viglione** Office of Consumer Counsel
Brenda Watson Executive Director Operation Fuel	**Bryan Garcia** President and CEO Connecticut Green Bank
Ronald J. Araujo Eversource	**Bert Hunter** EVP/CIO Finance Connecticut Green Bank
Jane Lano United Illuminating	

AGENDA

Joint Committee of the CT Energy Efficiency Board and the Connecticut Green Bank Board of Directors

Online

December 16, 2020
1:30pm – 3:00 pm

1. Call to Order
2. Public Comments (5 min)
3. Review and Approval of Minutes for September 16, 2020 (5 min)
4. 2021 Regular Schedule of Meetings (5 min)
5. Energy Jobs Report – Report Out and Next Steps (5-10 min)
6. Plan Coordination (30 min)
    a. Input to FY 2021 Connecticut Green Bank Comprehensive Plan
    b. 2022-2024 Conservation and Load Management Plan Process
7. Plans for the 2021 Legislative Session (10 min)
8. Other Business (20 min)
    a. Brief Update: C&I - Government (5 min)
    b. Brief Update: C&I – Small and Medium/Large Business (5 min)
    c. Brief Update: Residential – Single Family and Multi-Family (5 min)
    d. Other Business
9. Adjourn

Join the meeting online at https://global.gotomeeting.com/join/454049389

Or dial in using your telephone:
Dial: 1 (872) 240-3212 / Access Code: 454-049-389

RESOLUTIONS

Joint Committee of the CT Energy Efficiency Board and the Connecticut Green Bank Board of Directors

Online

December 16, 2020
1:30pm – 3:00 pm

1. Call to Order

2. Public Comments (5 min)

3. Review and Approval of Minutes for September 16, 2020 (5 min)

Resolution #1

Motion to approve the meeting minutes of the Joint Committee for September 16, 2020

4. 2021 Regular Schedule of Meetings (5 min)

Resolution #2

Motion to approve the 2021 Regular Schedule of Meetings

5. Energy Jobs Report – Report Out and Next Steps (5-10 min)

6. Plan Coordination (30 min)

    a. Input to FY 2021 Connecticut Green Bank Comprehensive Plan
    b. 2022-2024 Conservation and Load Management Plan Process

7. Plans for the 2021 Legislative Session (10 min)

8. Other Business (20 min)

    a. Brief Update: C&I - Government (5 min)
    b. Brief Update: C&I – Small and Medium/Large Business (5 min)
    c. Brief Update: Residential – Single Family and Multi-Family (5 min)
    d. Other Business

9. Adjourn

Join the meeting online at https://global.gotomeeting.com/join/454049389

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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** – per Executive Order 7B (i.e., suspension of in-person open meeting requirements), we need to record and post this board meeting.

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

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Joint Committee

Connecticut Energy Efficiency Board and the Connecticut Green Bank Board of Directors

Online
December 16, 2020

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Agenda Item #1

Call to Order

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Agenda Item #2

Public Comments

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Agenda Item #3

Approval of Meeting Minutes for September 16, 2020

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Agenda Item #4

2021 Regular Schedule of Meetings

2021 Regular Schedule of Meetings

- **March 17, 2021** – Wednesday from 1:30-3:30 p.m.
- **June 16, 2021** – Wednesday from 1:30-3:30 p.m.
- **September 15, 2021** – Wednesday from 1:30-3:30 p.m.
- **December 15, 2021** – Wednesday from 1:30-3:30 p.m.

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Agenda Item #5

Energy Jobs Report

Connecticut Clean Energy Industry Report 2020
USCA 2020 Jobs in the Clean Energy Economy

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Clean Energy Industry Report
Next Steps

- **Press Release** – distributed Nov. 10
- **Webinar** – presented on Nov. 18 to 51 attendees (80 total registrants). Presenters were: Joint Committee, DOL, [bw] Research, EDCs, and five contractors
- **Media Coverage** – articles appeared in Hartford Business Journal, CT Patch, WSHU, Waterbury Rep-Am, North American Clean Energy, electrek.com. Radio interview on "For The People"
- **Fact Sheet** – develop a one-page fact sheet that can be used during the legislative session
- **FY 2021 Report** – continue collaboration through Joint Committee with DEEP, EDCs and Green Bank to support report for FY 2021 with [bw] Research Partnerships

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Agenda Item #6a

Plan Coordination

FY 2021 Connecticut Green Bank Comprehensive Plan – Green Bonds US

Connecticut Green Bank Comprehensive Plan – Green Bonds US

- **“vulnerable communities”** – propose including recent definition passed in “Take Back Our Grid Act” into the goals
- **Equity Target** – propose establishing vulnerable communities target of no less than 40 percent of investment from incentive and financing programs by 2025
- **Target** – consider revising some of our FY 2021 targets given better than expected performance
- **Programs** – including programs we have developed to support implementation of Comprehensive Plan (e.g., RSIP-E, Solarize Storage, etc.)

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Connecticut Green Bank

FY 2021 Targets (DRAFT)

Incentive Programs

Program / Product	Projects	Total Investment ($MM's)	Installed Capacity (kW)	Ann. GHG Emissions Avoided (TCO2)
Residential Solar Investment Program	2,824-4,706	$85.9-$143.2	24,000-40,000	15,107-25,178
Solar for All Program	177-304	$4.3-$7.4	1,200-2,000	724-1,246
Equitable Modern Grid[34]	0-400	$0.0-$3.5	0-2,000	-
EnergizeCT Smart-E Loan	270-540	$3.6-$7.1	0.3-0.6	1,972-3,937
Total[35]	**3,094-5,646**	**$89.5-$153.8**	**25,200-44,000**	**16,877-28,712**

Financing Programs

Program / Product	Projects	Total Investment ($MM's)	Installed Capacity (kW)	Ann. GHG Emissions Avoided (TCO2)
Commercial PACE	33-48	$15.2-$23.3	5,300-7,100	1,452-1,641
Green Bank Solar PPA	30-58	$4.0-$6.8	6,200-11,700	3,940-7,402
Small Business Energy Advantage	1,203	$20.4	-	-
Multifamily Predevelopment Loan	1	$0.1	-	-
Multifamily Term Loan	2	$0.2	0.1	68
Multifamily Health & Safety	1	$0.1	-	-
EV Offset Program	-	-	-	17,770
Strategic Investments	3	$7.8	-	-
Total	**1,267-1,309**	**$46.1-$74.5**	**10,900-18,100**	**22,684-26,272**

Current Performance

- **RSIP** – 3,504, $110.3, 31,000
- **Solar for All** – 488, $12.4, 3,300
- **Smart-E Loan** – 375, $6.1, 600
- **C-PACE** – 18, $11.5, 1,300
- **Solar PPA** – 0, $0, 0
- **SBEA** – 0, $0, 0
- **Multifamily** – 3, $1.0, 40
- **Strategic Investment** – 0, $0, 0

REFERENCES

Current Performance – RSIP (as of December 1, 2020), PosiGen (as of November 30, 2020), Smart-E Loan (as of November 1, 2020), C-PACE, Solar PPA, SBEA, and Multifamily (as of December 14, 2020)

Green Liberty Bonds

Celebrating the 50th Anniversary of Earth Day

THE BOND BUYER

DEAL of the YEAR

INNOVATION AWARDS WINNER 2020

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Agenda Item #6b

Plan Coordination 2022-2024 Conservation and Load Management Plan

2019-2021 Plan Priorities

1. Advance State Energy & Environmental Policy Goals
2. Offer Tailored Solutions for Market Segments While Ensuring Equitable Distribution
3. Focus on Direct Savings to Customers
4. Develop and Maintain a Sustainable Workforce
5. Continuous Commitment to Deliver Comprehensive Energy Efficiency Strategies
6. Implement Effective Demand Reduction Strategies
7. Continue to Explore and Implement Financing Options

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2022-2024 C&LM Plan Board Schedule

Month	Board Activities
November	Review Draft 2022-2024 Plan Schedule
December	Discuss Three-Year Plan Opportunities and Challenges
January	**Develop Questions for Stakeholders and Public Input Sessions**
February	**Review and Discuss PMI Structure, Weights, etc. and Identify Areas for Potential Revision**
March	**Residential and Low-income Program Discussion** Public Input Session #1
April	**Demand Response and Electrification Program Discussion** **Avoided Energy Supply Cost Study Discussion**
May	**C&I Program Discussion** Public Input Session #2
June	**Marketing, Education and Workforce Development Discussion**
July	Review and Discuss Initial Draft Plan Text and Revised PMI Structure
August	**Review & Comment on Initial Revenue, Savings and Budget Projections & PMI Values** Review revised Plan text
September	**Vote on Plan Text** Review revised revenue, savings and budget projection
October	**Vote on Plan Tables**

Linkages Between Statute and Programs

C&LM PROGRAMS: may include, but are not limited to:

- Conservation and load management programs
- Programs that benefit low-income people
- Research, development and commercialization of energy efficient products
- Development of markets for such products
- Support of energy use assessments, demand response, engineering related to new construction or renovations

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Linkages Between Statute and Programs (cont.)

- Design, manufacture, commercialization, and purchase of energy efficiency appliances and HVAC equipment
- Program planning and evaluation
- Indoor air quality programs
- Joint fuel conservation to reduce the energy consumption of more than one fuel source
- Water conservation
- Public education
- Demand side technology programs

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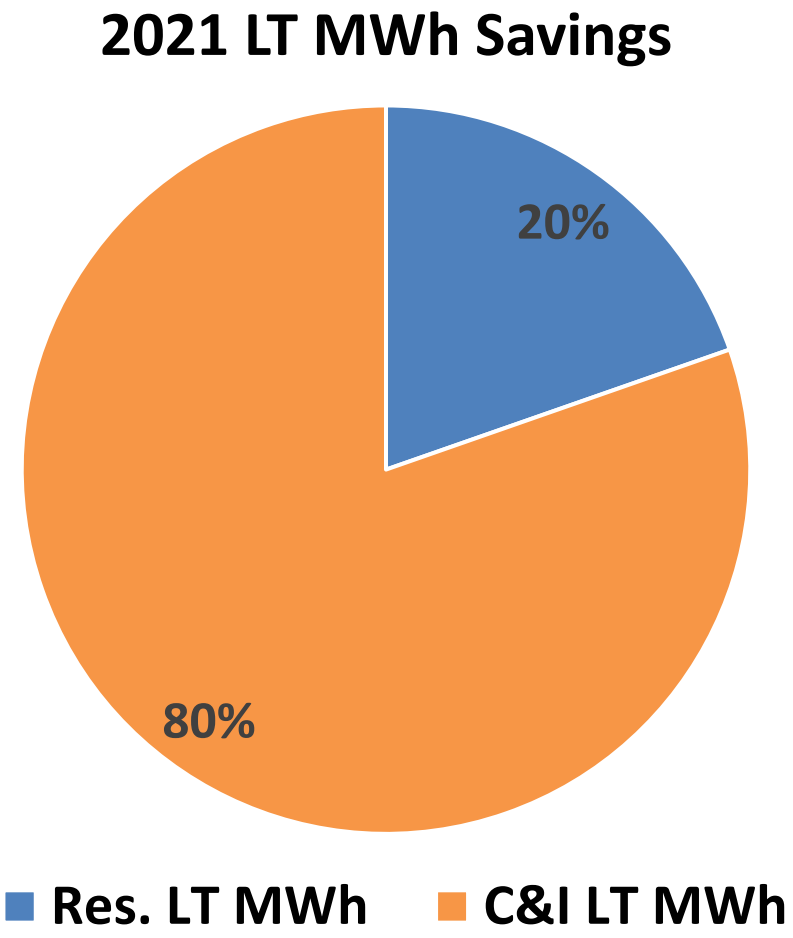
Large Majority of Lifetime Electric Savings are from C&I



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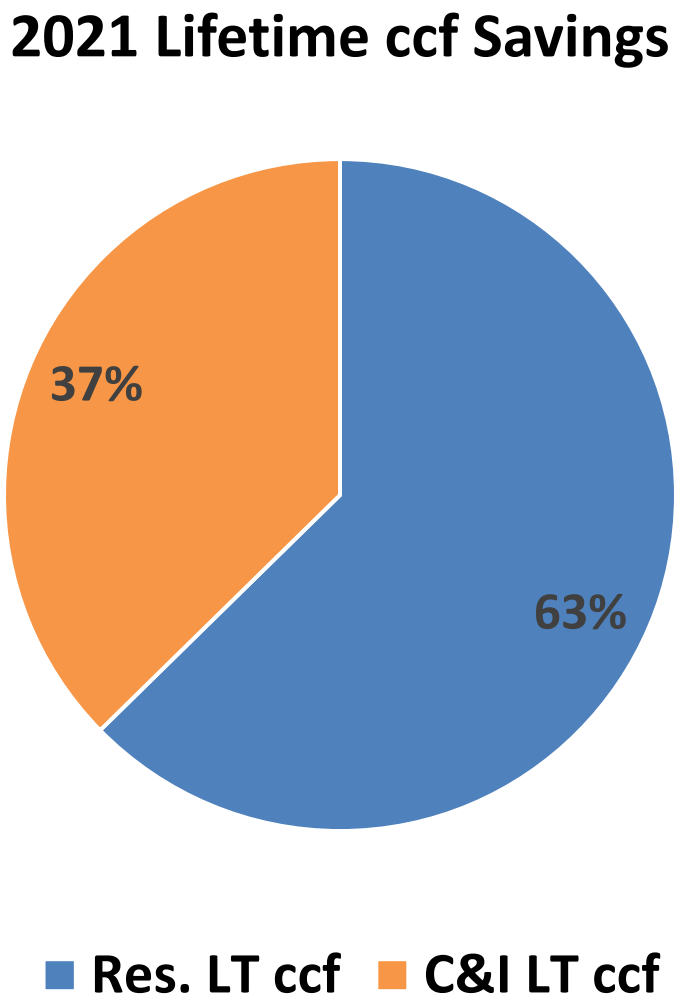
While Majority of Lifetime Gas Savings are from Residential



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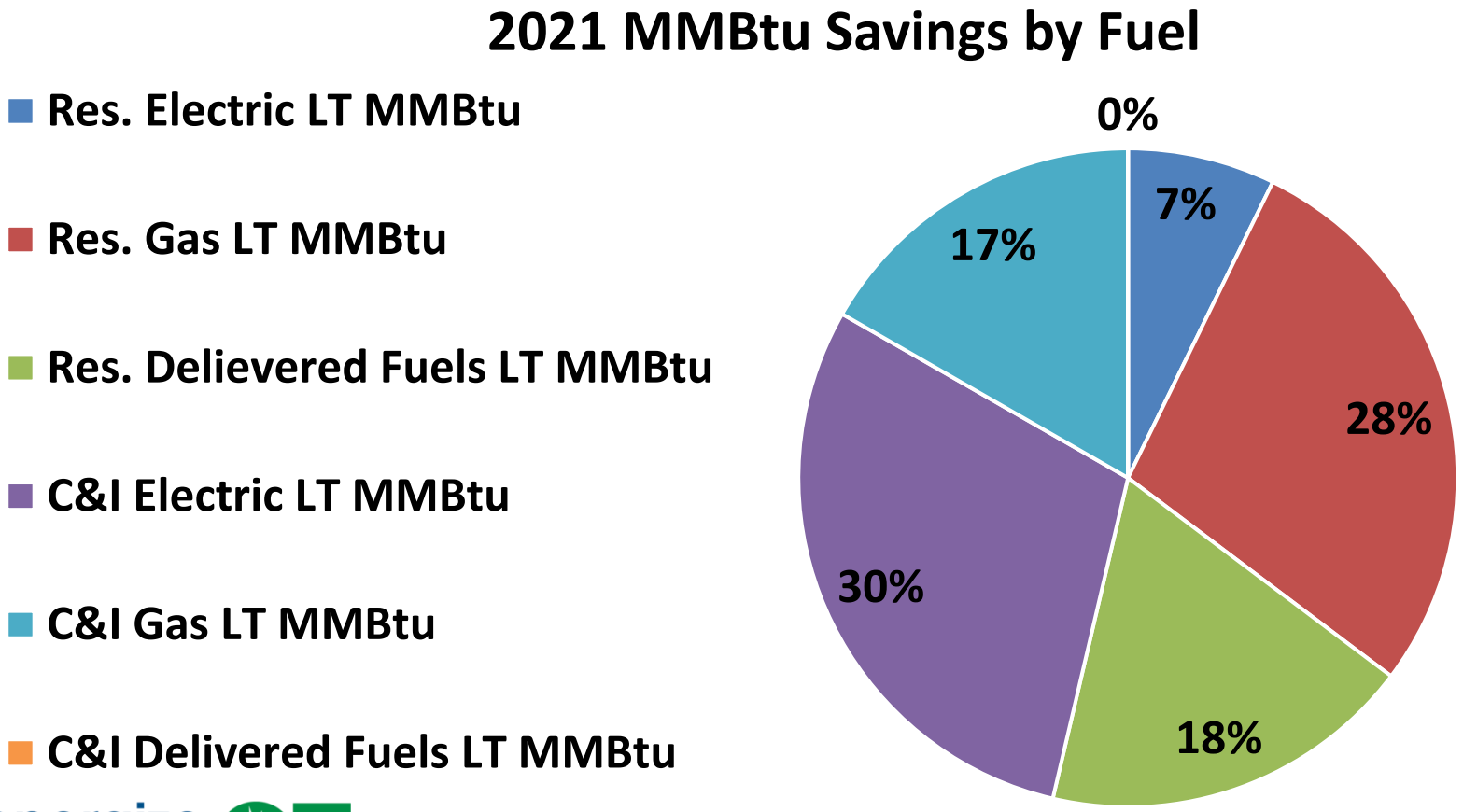
And Total Lifetime Energy Savings Are Nearly Evenly Split Between the Two Sectors

54% Residential / 46% C&I



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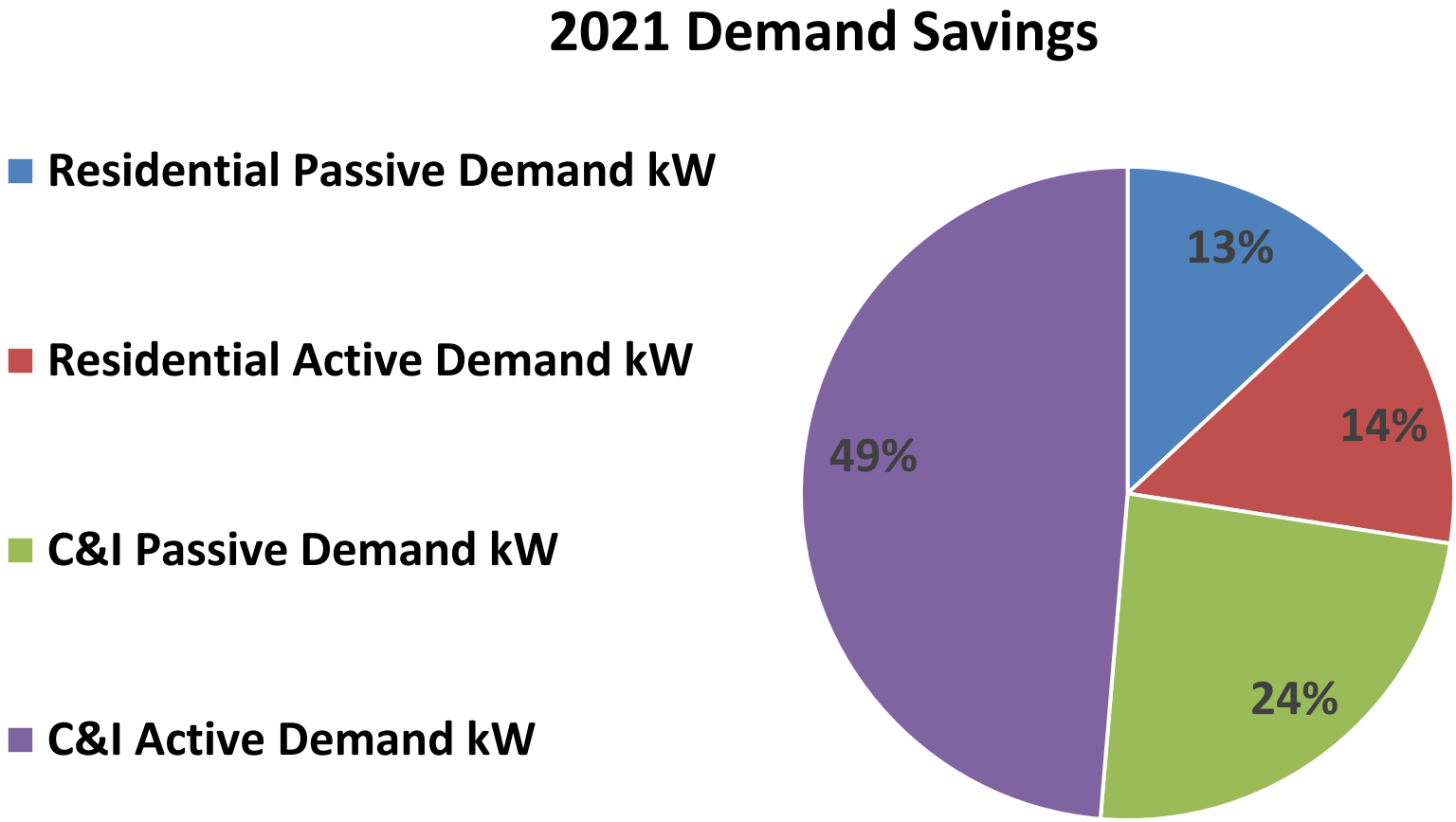
Nearly Three Quarters of Demand Savings Comes from C&I

27% Residential / 73% C&I



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Agenda Item #7

Plans for the 2021 Legislative Session

Green Bank Legislative Priorities

- **Environmental Infrastructure** – expands the Green Bank's ability to provide bonding support for state environmental policy goals around water, waste and recycling, climate adaptation and resiliency, agriculture and conservation.
- **Residential Solar PV** – to support "sustained orderly development of local solar industry" (i.e., through COVID), raise the RSIP incentive capacity cap by 100 MW as a bridge to tariffs, while providing PURA flexibility on tariff implementation.
- **C-PACE Program** – Allow EV charging and climate resiliency measures to qualify; optimize other program features and remove certain municipal obligations.
- **Property Tax** – Prospectively clarify the Class I exemption to resolve confusion on third-party owned residential solar.

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Agenda Item #8a

Other Business

Brief Update: C&I – Government

Brief Update
Government

- **Small Business Energy Advantage** loan size expanded for state and municipal governments

Utility	Maximum Loan Amount	Maximum Loan Term
Eversource	$1M per project	7 years (from 4)
UI	$500k per State agency / municipality	5 years (from 4)

- **Eversource State / Muni loans (Part of overall SBEA Loan Recap)**
  - *New State/Muni loans issued in 2020*
    - *~67 Projects (~20 Muni + State) - $1.7 M*
  - *State/Muni Loans resold/recapped since 2018: 433 projects - $9.1M*

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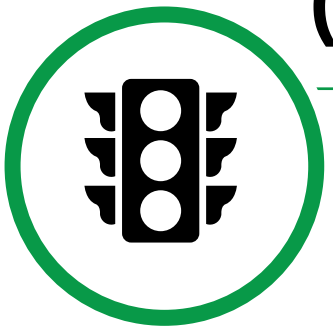
Agenda Item #8b

Other Business

Brief Update: C&I – Small, Medium, and Large Business

C&I "Savings are Essential" Incentive (aka Stimulus Incentives)



Tiered Incentives

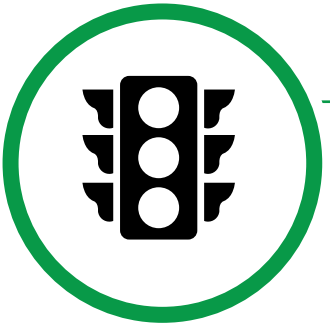
	GREATER OF		PLUS	Not to exceed
	per kWh	per kW	per CCF	PROJECT CAP
TOTAL COMPREHENSIVE INCENTIVE				
Three or more End Uses	$0.75	$1000/ summer peak	$6.50	75% of Installed Cost
MULTI END USE OR EMS				
Minimum two End Uses	$0.60	$1000/ summer peak	$5.50	60% of Installed Cost
SINGLE NON LIGHTING END USE				
Minimum one non-lighting End Use	$0.50	$1000	$4.50	50% of Installed Cost

Lighting

	GREATER OF		PLUS	Not to exceed
	per kWh	per kW	per CCF	PROJECT CAP
HIGH PERFORMANCE LIGHTING				
LED Fixtures with Networked Lighting Controls System	$0.75	$1000/ summer peak	NA	75% of Installed Cost
ENHANCED PERFORMANCE LIGHTING				
LED Lighting with Luminaire Level Lighting Controls or Wirelessly Accessible Controls	$0.55	$1000/ summer peak	NA	60% of Installed Cost
STANDARD LIGHTING				
Must use Expeditied Lighting Application	$0.40	$1000/ summer peak	NA	45% of Installed Cost

80% "distressed" incentive available for qualifying customers

C&I Actions



- Executed contract addenda with SBEA vendors to facilitate safe resumption of on-site work
- 6 month loan deferment offered to SBEA customers
- Virtual pre-assessment offering transitioned to program
- Progress payments commensurate with % work completed
- UI launched online limited-time-offer to C&I customers
  - Deeply discounted energy-saving product bundles
- SBEA aggregation rules relaxed
- Microbusiness Energy Advantage (MBEA) pilot launched to target smallest commercial customers

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Brief Update
Small, Medium, and Large Business

- **C-PACE** has provided financing in FY21 to 18 projects for a total of $11.5m. This is 62% and 84%, respectively, of the goals so on target to meet or exceed them.
- Launched **ChargeUp CT Buildings** and flexible repayment offers for **C-PACE**
- UI SBEA Update
  - SBEA/Muni - Loans Issued in 2020 – 128 new loans; $ 2.6 M;
    - (ref. 2019 – 164 loans; $2.98M)
- Eversource SBEA Update
  - SBEA/Muni - Loans Issued in 2020 – 359 new loans; $ 6.5 M;
    - (ref. 2019 – 800 loans; $14.1M)
  - SBEA/Muni loans resold/recapped since 2018 – 5,102 loans; $61M
- Eversource BEA financing
  - # 3 loans, $226K
  - Formal roll-out January 2021

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Agenda Item #8c

Other Business

Brief Update: Residential – Single Family and Multifamily

Brief Update
Single Family and Multifamily

- **Single Family**
  - HES Incentives change at end of first quarter
  - New Air Source Heat Pump (ASHP) Qualified Product List (QPL)
  - Two tiers of heat pump incentives
- **Multifamily**
  - Program will look very similar to 2020
  - Adopting the new ASHP heat pump QPL
  - Continuing to offer the electric resistance to heat pump conversion incentives

2021 HES Incentives

- As of April 1, 2021, newly-enrolled customers will pay $50

HES Co-Payment

- **Customers with HES assessment conducted prior to April 1, 2021** = $2.20/sq. ft. with installation and rebate form submitted by June 30, 2021
- **Customers assessments performed after April 1, 2021** = $1.70/sq. ft.

Insulation

- **Double-pane windows:** HES participants qualify for $50/window rebate through December 31, 2021
- **Triple-pane windows:** Offering standalone $100/window rebate through December 31, 2021

Windows

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2021 Heat Pump Incentives

Ground-Source Heat Pumps

- **Electric heat:** $750/ton, up to $10,000/home
- **Oil/Propane heat:** $1,500/ton, up to $10,000 home

Air-Source Heat Pumps

- New ASHP Qualified Product List effective April 1, 2021
  - Effective for April 1 to December 31, 2021 sales, aligns with regional HP qualification criteria
- New mini-split HP two-tier ASHP incentive structure effective Jan. 1, 2021 (*must meet qualifying SEER/HSPF criteria*)*
- **HES participant rebates:**
  - ASHP HES rebate: $1,000/ton electric resistance
  - Fuel Optimization HP Pilot
    - Ducted/Ductless HP: $1,000/ton
    - Integrated controls with legacy heating unit: $500/unit up to $1,500/home

*Mini-split HP two-tier ASHP incentive structure does not require a minimum Heating Capacity Ratio to qualify for an incentive.

2021 ASHP Incentives

Ductless Single-Zone ASHP

- **Tier 1: $250/ton***
  - Specifications: ≥ 18 SEER, ≥ 10 HSPF, 58% Heating Capacity Ratio (47°F to 17°F)
- **Tier 2: $500/ton***
  - Specifications: ≥ 22 SEER, ≥ 10 HSPF, 58% Heating Capacity Ratio (47°F to 17°F)

Ducted and/or Ductless Multi-Zone ASHP

- **Tier 1: $250/ton***
  - Specifications: ≥ 16 SEER, ≥ 9.5 HSPF, 58% Heating Capacity Ratio (47°F to 17°F)
- **Tier 2: $500/ton***
  - Specifications: ≥ 20 SEER, ≥ 10 HSPF, 58% Heating Capacity Ratio (47°F to 17°F)

Central Air Source HP: $500/ton*

- ≥ 16 SEER, ≥ 9.5 HSPF, 60% Heating Capacity Ratio (47°F to 17°F)

*Up to two systems per home.

Multifamily Building Electric Heating & Cooling Systems Incentives

Multifamily buildings currently with electric-resistance heating and cooling systems eligible for **enhanced incentives** to convert to a heat pump system

Individual Dwelling Unit – Conversion to Heat Pump System		
	Market Rate Property Owner Incentive	Income-Eligible Property Owner Incentive
Heat pump system for Small Multifamily (2-19 attached dwelling units)	$3,000/unit or up to 100% of the installation cost (based on estimated energy savings)	Up to 100% of installation cost (based on estimated energy savings)
Heat pump system for Large Multifamily (20 or more attached dwelling units)	$1.60/kWh saved, capped at 50% of total project cost	$1.60/kWh saved, capped at 80% of total project cost
Heat Pump Control Integration for 1-19 dwelling unit properties	$500/system, up to $1,500/single family home	$500/system, up to $1,500/single family home

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Brief Update
Single Family and Multifamily

- HES Payment Plan/Micro Loan
  - Expanded to include HES-IE
  - Expanded to include other measures windows, heat pumps
  - Lowered the minimum loan from $1,000 to $500
- Single Family Loan Volumes (2020 vs. 2019)

Program	2019 # of loans	2019 $ amount	YTD Nov -2020 # of loans	YTD Nov -2020 $ amount
Heating Loan	1,965	$17,331,028	1,848	$16,765,983
HES/CHIF	349	$1,015,318	152	$357,095
ECLP	27	$276,924	20	$268,485
Smart E	744	$11,268,851	491	$7,466,170
total	3,085	$29,892,120	2,511	$24,857,733

Brief Update
Single Family and Multifamily

- **Smart-E Loan** volume is exceeding expectations, with 70 closed loans per month (target 45). The 2.99% special offer for heat pumps, solar battery storage and EV chargers is expected to be available through Q3.
- **PosiGen (Solar for All)** ran two campaigns in Bristol and Mansfield/Windham and is looking to run another two – in Waterbury and Norwalk - in 2021.
- **Multifamily** focus has been on ECT Health & Safety Revolving Loan Fund and solar outreach. Supporting CHFA & DOH Sustainability Work Group. Launch of market rate LIME – spring 2021. Touched nearly 10% of affordable MF units in CT.

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Agenda Item #9

Adjourn

Draft MINUTES

Joint Committee of the CT Energy Efficiency Board and the Connecticut Green Bank Board of Directors

Wednesday, September 16, 2020
1:30-3:30 p.m.

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

In Attendance

Voting Members: Eric Brown, John Harrity, Michael Li, Brenda Watson

Non-Voting Members: Stephen Bruno, Bryan Garcia, Linda King, Donna Wells

Members Absent: Bert Hunter, John Viglione

Others: Lonnie Reed, Ron Araujo, Emily Basham, Sergio Carrillo, Gentiana Darragjati, Mackey Dykes, Brian Farnen, Joel Kopylec, Liz Murphy, Glenn Reed, Lawrence Rush, Cheryl Samuels, Ariel Schneider

Unnamed Callers: 01, 02, 05, 06, 07, "Ashley"

1. Call to Order

   Eric Brown called the meeting to order at 1:32 pm.

2. Public Comments

   No public comments.

Eric Brown introduced the new member to the Joint Committee: John Viglione.

3. Review and approval of Meeting Minutes from the June 17, 2020 meeting.

Resolution #1

Motion to approve the meeting minutes for June 17, 2020.

Upon a motion made by John Harrity and seconded by Brenda Watson, the Joint Committee voted to approve Resolution 1. None abstained or opposed. Motion approved unanimously.

4. Energy Jobs Report – Report Out and Next Steps

- Bryan Garcia summarized the CT Clean Energy Industry Report process of development leading up to present which is the finalization of the report. Next steps ideas include a press release, webinar, and the continued collaboration to support the report.
    - Stephen Bruno and Lonnie Reed supported the idea of a press release. The group discussed both in-person and online ideas.
    - John Harrity noted the urgency of releasing the report.
    - Bryan Garcia asked if the Committee would want to continue collaborating in FY21 to continue to track the data. Lonnie Reed and Brenda Watson supported the idea. John Harrity asked if Bryan Garcia could ask BW Research if they expect there to be many changes over the coming year. Bryan Garcia answered that he could arrange a meeting with BW Research to discuss the potential scope of work.

5. 2021 Conservation & Load Management Plan Update

- Glenn Reed summarized the 2019-2021 Plan status in progressing into the third year.
- Stephen Bruno summarized the Plan priorities and key items which includes an overview of the response to COVID-19. He continued to review the 2021 Revenue, Budget, and Lifetime Savings. 2021 budgets are pretty consistent with the 3/1/20 filing; However, the savings are reduced based on higher incentive level assumptions into 2021 combined with program changes to retail lighting products. Changes to the Program Savings Document were incorporated.
- Stephen Bruno stated progress should have the Plan presented for Board approval for filing in November 2020.
- Bryan Garcia reviewed the Green Bank's support of the Plan through its various programs.
    - Stephen Bruno noted for Medium to Large business program is similar to the Small Business program but should allow for more businesses to participate. Due to COVID-19 the volume has decreased but hopes it will bounce back with more offerings.
    - Glenn Reed had previously asked if there has been a reduced need for financing within programs due to COVID-19. Bryan Garcia answered that within the programs there is not a reduction for demand. Stephen Bruno also noted that the volumes within the programs are pretty consistent to 2019 since the offerings resumed.
- Michael Li summarized the plan to host a workshop on how to address health and safety barriers to sustainability, possibly within the Green & Healthy Homes Initiative.

6. Debrief on Legislative (e.g., LCO No. 3920) and Regulatory (e.g., Docket No. 17-12-03) Matters

- Michael Li summarized the changes to LCO No. 3920. This includes provisions on a spoiled food initiative, wholesale market, resilience program, independent consumer advocate board, third party administration.
    - John Harrity asked if how much of the proposed language changes are due to reaction to the perceived failed adequacy to storms versus climate change. Bryan Garcia clarified it was a special session bill specifically for storm response and rate increases.
- Bryan Garcia summarized the reopeners to Docket 17-12-03.
    - Bryan Garcia provided an overview of the Green Bank Solarize Storage proposal submission into Docket No. 17-12-03RE03. He emphasized the

role of the Joint Committee and partners in the proposal, including Eversource and UI administering an active demand response program for ongoing incentives through the C&LM Plan, with the Green Bank administering an upfront incentive program.
    - Stephen Bruno asked if there was any update as to timing as to review the reopeners. Bryan Garcia stated he did not know.
    - John Harrity asked what 50,000 households with solar PV represented. Bryan Garcia answered that it would be approximately 5-10% of potential homes based on prior Geostellar report on market potential for the Green Bank.

7. Other Business

    - Bryan Garcia summarized the framework of the E^4 Architecture and the focus on equity instead of equality.
    - Bryan Garcia reviewed the work done to better two equity metrics: income and race. Work is being done with the Department of Banking to establish income classifications around the Community Reinvestment Act. For race, working with the Commission on Human Rights and Opportunities.
        - Brenda Watson noted the benefit of the data collected.
        - John Harrity asked for clarification as to progress made to those who rent as a response to the low homeowner numbers. Brenda Watson answered that there are Shared Solar programs and other means for renters to participate, but there are opportunities to increase outreach. Emily Basham also expanded on the programs present.

8. Adjourn

Upon a motion made by Brenda Watson and seconded by John Harrity, the Joint Committee Meeting adjourned at 2:45 pm.

Respectfully submitted,

_____

Eric Brown, Chairperson

Joint Committee of the CT Energy Efficiency Board and the Connecticut Green Bank Board of Directors

REGULAR QUARTERLY MEETING SCHEDULE FOR 2021

The following is a list of dates and times for **regular meetings** of the Connecticut Green Bank and the Connecticut Energy Efficiency Board through 2021

- **March 17, 2021** – Wednesday from 1:30-3:30 p.m.
  Location: TBD
- **June 16, 2021** – Wednesday from 1:30-3:30 p.m.
  Location: TBD
- **September 15, 2021** – Wednesday from 1:30-3:30 p.m.
  Location: TBD
- **December 15, 2021** – Wednesday from 1:30-3:30 p.m.
  Location: TBD

Should a **special meeting** be needed to address other issues that arise, a meeting will be scheduled accordingly.

UNITED STATES
CLIMATE ALLIANCE

2020

JOBS IN THE CLEAN ENERGY ECONOMY

[bw] RESEARCH PARTNERSHIP

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About This Report

The United States Climate Alliance (USCA) commissioned BW Research Partnership to produce the following 2020 Clean Energy Employment Report. The report details clean energy employment from 2016 through 2019 [1] aggregated across the 24 Alliance states. [2] Specifically, this report includes total jobs for each clean energy technology sector as well as their component sub-technologies and industry, or value chain, segments. [3] The major clean energy sectors examined in this report are featured below in Table 1.

It is important to note that the U.S. Climate Alliance does not have an agreed upon definition of clean energy, nor is this report intended to define clean energy. A set of technologies is defined solely for the purpose of aggregating data across states. Each state may define clean energy differently; these differences are captured in each state's fact sheet and in independently commissioned state-specific clean energy jobs reports.

Data in this report is based on the overall 2020 United States Energy and Employment Report (USEER)[4], an annual report that has been tracking energy jobs across the nation since 2015. The methodology relies on the most recently available data from the BLS Quarterly Census of Employment and Wages (QCEW), together with a detailed supplemental survey of business establishments across the United States. Together, the BLS and survey data provide the most comprehensive calculation of energy employment available. This methodology has been used for local, state, and federal energy employment data collection and analysis for nearly a decade, including the Solar Foundation's *National Solar Jobs Census* series, clean energy reports for state agencies in Massachusetts, New York, Vermont, Rhode Island, and numerous nonprofit agencies across the United States. The USEER survey was administered by telephone and web, and roughly 25,000 business establishments participated in the effort, resulting in a margin of error for incidence in the index of +/- 0.62 percent at a 95 percent confidence interval.

The report provides an Alliance state-aggregated overview of clean energy workforce demographics, such as race, ethnicity, gender, age, veteran status, union membership, and educational attainment, as well as employer needs related to hiring difficulty and business growth. Appendix A provides occupational wages across all clean energy technology sectors. Appendix B includes a more focused examination of 10 clean energy occupations, detailing career pathway information such as employment benefits, necessary knowledge and skills, wages for multiple career stages, typical certifications, and promotion opportunities.

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[1] Clean energy jobs data is portrayed back to 2016 as this is the earliest year of data collection with sufficiently similar methodologies to allow for year-over-year growth comparisons.

[2] Though Puerto Rico is part of the Climate Alliance, there is insufficient data to profile Puerto Rico's clean energy jobs.

[3] It should be noted that individual state reports may include or exclude different sub-technologies in their definition of clean energy. For the purposes of this report clean energy technologies are defined by the U.S. Climate Alliance; the list of these may be found in Appendix E.

[4] https://www.usenergyjobs.org/

Altogether, the data in this report highlight how the Alliance states have provided a national and global example for how climate mitigation policies and job growth could go hand-in-hand. The report is not meant to be a roadmap for workforce development initiatives, as these actions are best reserved for local- and state-level research efforts and partnerships. The focus of this report is to provide a clean energy jobs benchmark for the Alliance states. These data provide an overview of how many jobs were created between 2016 and 2019 and a framework through which to understand the growth and development of clean energy jobs by technology sector and industry value chain segment. A brief overview of job quality in this report is reserved to comparative wages and employment benefits data; a more robust or nuanced discussion on clean energy job quality may be considered for alternative avenues of research. It is important to advance both job quality and workforce standard alongside climate and clean energy policies. Efforts to prioritize job access and quality through growth of industries poised to reduce greenhouse gas emissions can provide opportunity for residents across Alliance states as they rebuild their economy.

This report was commissioned before the global Coronavirus (COVID-19) pandemic, which has significantly altered labor market and employment realities across the United States. The U.S. Climate Alliance's Clean Energy Employment Report is based on data collected in the last quarter of 2019, before the emergence of COVID-19 in the United States. As a result, the employment figures included throughout this report serve as a baseline of clean energy industry employment pre-pandemic. BW Research estimates that the Alliance states lost a net 301,541 clean energy jobs between March and August 2020 due to the COVID-19 economic fallout—a 3.4 percent decline compared to the 2019 baseline.[5]

Numerous economic uncertainties remain, including the volatility of policy and relief programs, the unpredictability of a novel virus, and future consumer spending patterns. As the nation experiences record levels of unemployment claims, it is difficult to forecast how the labor market and specific industry sectors will continue to respond to the aftershock of a nationwide economic shutdown. Nevertheless, the data presented in this report provide a useful baseline from which to understand historical clean energy job growth across the Alliance states. It will be important to track and understand the needs of clean energy employers as recovery unfolds. Targeted state-level workforce development and retraining research, initiatives, and partnerships could provide meaningful and actionable insight as the Alliance states' clean energy businesses seek to recover from the economic recession.

[5] Further employment analyses related to the COVID-19 pandemic's economic impacts can be found at http://bwresearch.com/covid19.

TABLE 1. FIVE CLEAN ENERGY TECHNOLOGY SECTORS

Technology Sector	Definition	Sample Job Titles
Energy Efficiency	The Energy Efficiency sector comprises the manufacture, wholesale trade, distribution, construction, installation, or repair and maintenance of any good or service that reduces electricity demand pursuant to the EPA's ENERGY STAR® Standards or the Department of Energy's Efficiency Standards. This also includes establishments that are involved with heating, ventilation, and air conditioning (HVAC) from renewable energy sources or that otherwise work to increase the energy efficiency of HVAC Systems.	• Heating, Ventilation, and Air Conditioning (HVAC) Mechanics and Installers • Electricians • Energy Auditors • Plumbers, Pipefitters, and Steamfitters • Insulation Workers • Construction Laborer
Clean Energy Generation	Clean Energy Generation is defined as the process of generating electric power from clean or renewable sources of energy, including solar, wind, geothermal, biomass, nuclear, or hydropower. This sector includes employment across utilities, construction, manufacturing, wholesale trade, and professional and business services such as engineering, consulting, legal, or financial support.	• Solar Photovoltaic Installers • Wind Turbine Technicians • Nuclear Engineers or Technicians • Power Plant Operators • Construction Laborers
Alternative Transportation	The Alternative Transportation sector includes the manufacture, wholesale trade, and repair and maintenance of, or professional and business service support for transportation vehicles and their component parts that use non-traditional fuel resources such as electricity, natural gas, hydrogen, or fuel cells.	• Assemblers and Fabricators • Automotive Service Technicians and Mechanics • Welders, Cutters, Solderers, and Brazers • Sales Representatives (Wholesale and Manufacturing)
Grid Modernization and Storage	Grid Modernization and Storage encompasses the research and development, manufacture, wholesale trade, construction, and professional and business service support for storage and grid modernization technologies such as smart grid and microgrids. Storage technologies include battery storage, pumped hydropower, mechanical storage, thermal storage, and biofuel and nuclear storage.	• Electric Power-Line Installers and Repairers • Electricians • First-Line Supervisors of Mechanics, Installers, and Repairers • Construction Laborers • Operating Engineers
Clean Fuels	Clean Fuels includes the production, manufacture, sales, distribution, and transport of non-fossil fuel substances that produce useful energy when they undergo a chemical or nuclear reaction. These include corn ethanol, woody and non-woody biomass, and nuclear fuels.	• Farmworkers and Laborers (Crop, Nursery, and Greenhouse) • Geological and Hydrologic Technicians • Agricultural Engineers • Soil and Plant Scientists • Industrial Production Managers

Executive Summary

KEY FINDINGS

As of the fourth quarter of 2019, there were 2.14 million clean energy workers[6], as defined in Table 1 above, across the Alliance states. For every 10,000 workers in the Alliance states' labor market, there were 254 clean energy jobs. Before the onset of COVID-19, clean energy workers represented about three percent of total jobs in these states. These included jobs such as engineers, chief executives, analysts, lawyers, and supervisors, as well as sales representatives, technicians, machinists, installers, electricians, assemblers, and welders. Much of employment is concentrated in the construction industry, which accounted for 43 percent of clean energy jobs in the Alliance states at the end of 2019.

Alliance states accounted for 55 percent of the U.S. population and 60 percent of all clean energy jobs in America.

As of August 2020, BW Research estimated that the economic downturn resulted in a net job loss of 301,541 workers, wiping out three years of job growth in under six months.[7] As with nearly all sectors of the economy, clean energy job losses occurred from March through May, with a slight return of roughly 87,000 clean energy jobs over June through August, resulting in the net loss of almost 302,000 jobs.

Concentration of clean energy activity in the Alliance states was on the rise prior to COVID-19.

Out of the 2.14 million clean energy workers employed as of 2019, just under 1.5 million were full-time equivalent workers that spent all their labor hours on clean energy work. This report counts all clean energy workers regardless of how much time they spend on clean energy-related activities. For example, an electrician that spends only a quarter of total labor hours installing energy-efficient lighting technologies is included in the overall clean energy jobs estimate. An estimate of full-time equivalent (FTE) clean energy identifies the change in intensity, or concentration, of clean energy activity. If the electrician begins to spend the majority of labor hours or all labor hours dedicated to installing or servicing efficient lighting technologies, this reflects as a corresponding increase in FTE clean energy jobs.

[6] This estimate is based on the U.S. Climate Alliance clean technology definition found in Appendix E. Other clean energy report estimates may vary based on decisions to either include or exclude specific sub-technologies as part of the clean energy economy, such as nuclear fuels and generation, traditional hydropower, corn ethanol, etc.

[7] These job losses are cumulative and based on March 2020 through August 2020.

An example can illustrate the importance of tracking FTE clean energy employment. If an HVAC firm had 6 installers in 2018 who occasionally installed heat pumps, and now has 6 installers who exclusively do so, there would be no change in the total number of clean energy workers reported. However, because the number of labor hours working with heat pumps has increased, FTE jobs would show a corresponding increase.

Across the Alliance states, FTE clean energy jobs have grown faster than the overall clean energy labor market. Between 2016 and 2019, FTE clean energy jobs across Alliance states grew by about 17 percent, or 220,348 workers. At the end of 2019, seven in ten (70 percent) clean energy workers spent all of their labor hours on clean energy-related activities, up from 64 percent in 2016.[8]

The energy efficiency sector represented the largest share of jobs and the greatest absolute growth.

Energy efficiency jobs accounted for 67 percent of all clean energy employment across the Alliance states. Between 2016 and 2019, this sector grew by just over eight percent, which resulted in an additional 109,312 jobs in three years. At the end of 2019, 63 percent of all energy efficiency jobs in America were found in one of the 24 Climate Alliance states. However, from March through July of 2020, the energy efficiency sector in the Alliance states shed the largest number of jobs related to COVID-19 employment losses. Energy efficiency firms accounted for 216,384 jobs lost, or 69 percent of total COVID-19 clean energy job losses over this time period.

Other major areas of growth prior to the COVID-19 pandemic included the grid modernization and storage sector and alternative transportation. Employment in these sectors grew by a respective 32 percent and 18 percent between 2016 and 2019, together equating to roughly 41,800 new jobs across the U.S. Climate Alliance states. However, as of July 2020, these sectors collectively lost 223,206 jobs.

Prior to COVID-19, clean energy employers reported difficulty finding qualified job applicants.

At the time of data collection, employers reported that they had significant difficulty finding qualified workers to fill open positions at their clean energy firms. One-third of Alliance state clean energy employers reported that hiring had been “very difficult” between 2018 and 2019 and another 52 percent of employers indicated that hiring had been “somewhat difficult”; in total, 85 percent of employers reported some level of hiring difficulty.

[8] For more information on FTE clean energy jobs, please refer to the Clean Energy Employment Overview section of this report.

Clean energy employers attributed setbacks to growing their business and expanding revenues largely to the lack of qualified talent. This varied by sector, but generally included technicians, sales representatives, management roles such as supervisors and directors, and engineers. However, since the COVID-19 pandemic, these realities have likely changed, as global, national, and regional economies have absorbed significant shocks to their labor markets.

Many clean energy jobs in the Alliance states provide above-average wages and employment benefits.

An electrician installing energy-efficient lighting or a sales representative selling electric vehicles and electric vehicle component parts earns more per hour compared to the average electrician or sales representative across the United States. Overall, 92 percent of surveyed clean energy occupations[9] in the Alliance states across all technology sectors and levels of experience are paid more than the same occupation's national median wage. This is especially true for entry-level clean energy jobs, where 98 percent of surveyed entry-level clean energy positions receive a premium over the national corresponding occupational medians. For example, an entry-level electrician[10] earns $16.06 per hour, according to the Bureau of Labor Statistics[11], while an entry-level electrician working in the energy efficiency sector earns $20.87 per hour, a 30 percent premium for possessing the skills and knowledge specific to energy-efficient technologies.

In addition, roughly 92 percent of clean energy employers reported that they provide some level of healthcare, either full or partial coverage for their clean energy employees. This is significantly higher than the national private sector average of 69 percent.[12] Similarly, just over 84 percent of clean energy employers also reported making contributions to some type of retirement plan for their workers; this is also higher than the national private sector average of 67 percent.[13]

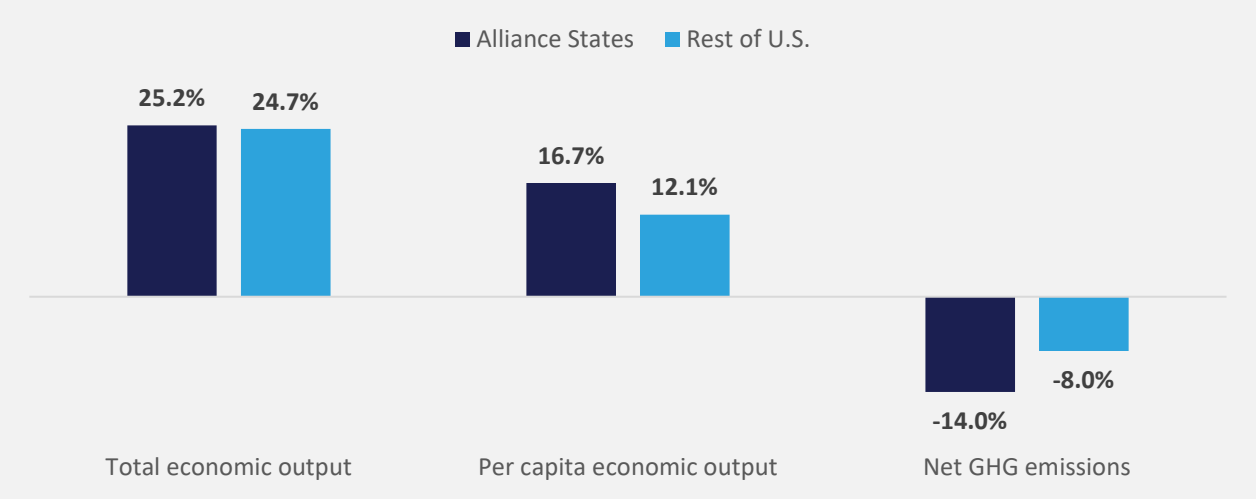
[9] This proportion is only out of surveyed occupations. Out of all 765 five-digit Standard Occupational Classification (SOC) codes from the Bureau of Labor Statistics, the dataset includes data on 78 occupations or SOCs—about 10 percent of all SOC codes.
[10] Entry-level wages in this report are defined at the 10th percentile.
[11] The occupational wages provided by the Bureau of Labor Statistics (BLS) also include clean energy jobs. For example, the national wage for electricians covers all electricians, including those working on energy efficiency-specific work. The entry-level electrician wage of $16.06 per hour is based on the 10th percentile wage from the Occupational Employment Statistics dataset from BLS (May 2019) and includes all electricians across all industries in the United States.
[12] Bureau of Labor Statistics. Employee Benefits in the United States, March 2019. https://www.bls.gov/news.release/pdf/ebs2.pdf.
[13] *Id.*

Introduction

Clean energy growth provides several benefits to statewide economies. These technologies represent a bridge to a lower-carbon future and provide both energy cost savings and job opportunities for residents. Because of this, 25 governors in the United States have committed to achieving the goals of the Paris Agreement by reducing GHG emissions by 26 to 28 percent below 2005 levels by 2025, with the knowledge that these commitments would not only help mitigate climate change but also create jobs. In addition to producing cleaner electricity, Alliance states have committed to tackling transportation emissions with policies that support the deployment of zero emission vehicles, as well as policies to increase battery storage capacity, building energy efficiency, and a number of other supportive programs that continue to reduce the Alliance states' GHG emissions and grow the clean energy labor market.

These measures have been successful thus far, as net GHG emissions declined by 14 percent between 2005 and 2018 in the Alliance states compared to only eight percent across non-Alliance states. At the same time, emissions reductions have not affected economic output over this same time period. In fact, per capita economic output in the Alliance states grew faster between 2005 and 2018 compared to non-Alliance states, indicating that sustained commitments to GHG reductions and the Paris Agreement can go hand-in-hand with economic growth.[14]

FIGURE 1. PERCENT CHANGE IN NET GHG EMISSIONS AND ECONOMIC OUTPUT, 2005-2018[15]



[14] United States Climate Alliance, 2020 Annual Report: https://www.usclimatealliance.org/annual-report.

[15] Emissions data – Rhodium Group Climate Service; GDP data – U.S. Bureau of Economic Analysis; Population data – U.S. Census Bureau.

This report highlights a particularly important component of a growing clean energy industry—the creation of employment opportunities for individuals across the country. Understanding the clean energy labor market is pivotal to identifying how policies support job growth in these sectors. Tracking and understanding labor market impacts of the clean energy economy is critical to ensuring that policy and decision-making are effective and data driven. Such considerations are particularly important as the global COVID-19 pandemic has shocked the nation's labor market, impacting clean energy businesses, and taking with it roughly 301,500 clean energy jobs from March 2020 through August 2020.

To develop a strong clean energy economy, state-level research and policy support can identify how to best support clean energy businesses. Now more than ever, developing policy support for industries can ensure that the clean energy economy continues to be a source of jobs for individuals across the nation.

Clean Energy Employment Overview

OVERALL CLEAN ENERGY EMPLOYMENT

While each Alliance state has different policy mechanisms in place to reduce GHG emissions, the policies generally include the same five technology sectors discussed in Table 1. These technologies are geared towards advancing zero-carbon electricity generation; energy efficiency building, appliance, and lighting upgrades; zero-emission vehicles; improved grid infrastructure and energy storage capacities; and clean fuels production. Numerous state-level policy efforts have led to the creation of jobs in these clean energy technology sectors.

For the purposes of this report, clean energy technologies are those which produce energy without polluting the atmosphere with net GHG emissions. These include renewable resources such as solar, wind, biomass, and hydroelectric power as well as other carbon-free resources like nuclear power generation and nuclear fuels. The report does not include jobs from fossil fuel industries such as coal, oil, or natural gas fuels for electric power generation or transportation, though the production of natural gas fuel vehicles is included. In addition to clean electric power generation, clean energy sectors in this report also include technologies that improve overall building HVAC and appliance efficiency and insulation, battery storage and grid modernization technologies, electric and hybrid vehicles, and corn ethanol, woody biomass, and other biofuels.[16]

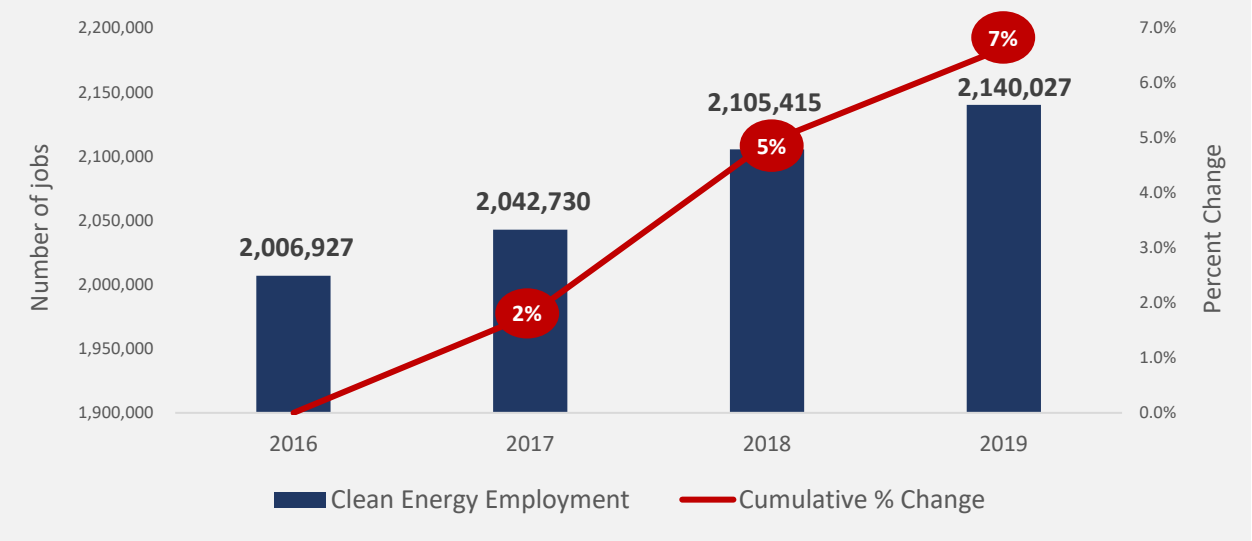
Overall, clean energy jobs across the 24 Climate Alliance states[17] grew by almost seven percent between 2016 and 2019[18], resulting in 133,100 new jobs in three years. The 24 states that comprise the U.S. Climate Alliance accounted for only 55 percent of all jobs in the United States at the end of 2019, but they supported 60 percent of all clean energy jobs across the country. For every 10,000 workers across the 24 Climate Alliance states in 2019, there were 254 clean energy jobs.

[16] For a full list of clean energy technologies and sub-technologies included in the U.S. Climate Alliance definition for clean energy, please refer to the Clean Energy Technology List in Appendix E.

[17] The 24 Climate Alliance states include California, Colorado, Connecticut, Delaware, Hawaii, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nevada, New Jersey, New Mexico, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, Washington, and Wisconsin. Puerto Rico is also part of the U.S. Climate Alliance, but there is insufficient data to report on clean energy jobs.

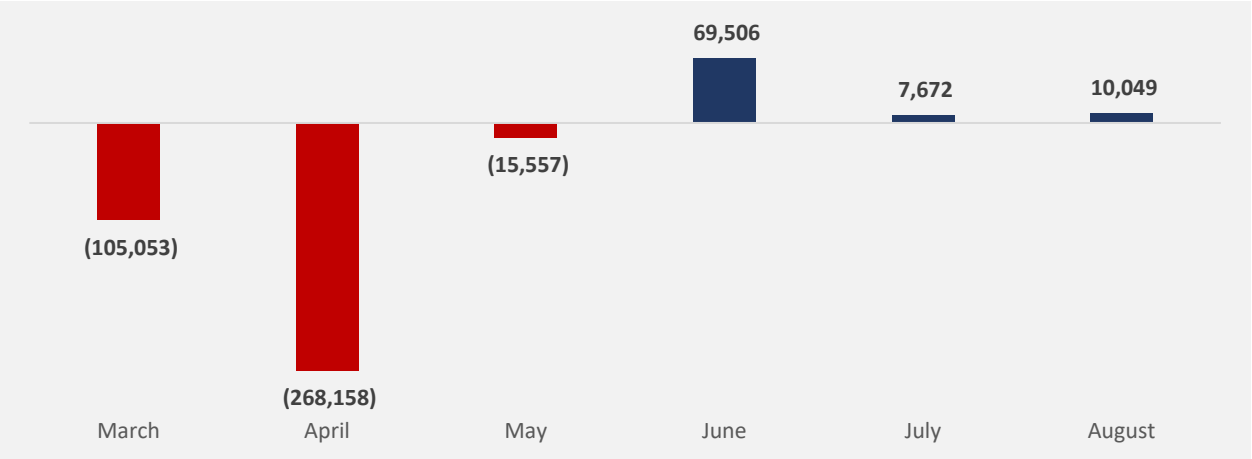
[18] Clean energy jobs data is portrayed back to 2016 as this is the earliest year of data collection with sufficiently similar methodologies to allow for year-over-year growth comparisons.

FIGURE 2. ALLIANCE STATES' CLEAN ENERGY EMPLOYMENT TOTALS, 2016-2019



It is important to note that the data for this report was collected in the last quarter of 2019, before the onset of the global COVID-19 pandemic. As such, the jobs data in this report provides an important benchmark or baseline against which to measure overall clean energy jobs and historical job growth across the Alliance states. From March through August 2020, the Alliance states' clean energy industry shed a net 301,541 jobs, with losses concentrated in March through May. Starting in June, the clean energy economy began to rebound, adding 87,227 workers back to the labor market through August.

FIGURE 3. ALLIANCE STATES' COVID-19 CLEAN ENERGY JOB CHANGES BY MONTH, MARCH-AUGUST 2020



The energy efficiency sector—the largest clean energy sector by employment—shed the greatest number of jobs, followed by clean energy generation. Energy efficiency businesses in the Alliance states accounted for 69 percent of total job COVID-19 job losses from March through August; this equates to roughly 207,000 jobs. Clean energy generation firms, meanwhile, shed about 56,000 jobs—or almost 19 percent of total job losses through August 2020.

With regards to job losses by value chain segment, the construction industry accounted for the majority of jobs lost from March through August. About 167,600 clean energy construction jobs were lost, accounting for roughly 56 percent of total job losses by value chain segment. Professional and business services shed about 20 percent of jobs—or 58,900 workers—followed by manufacturing with 41,400 job losses, or 14 percent of all jobs lost by value chain segment.

FIGURE 4. ALLIANCE STATES' COVID-19 CLEAN ENERGY JOB LOSSES BY TECHNOLOGY SECTOR, MARCH-AUGUST 2020

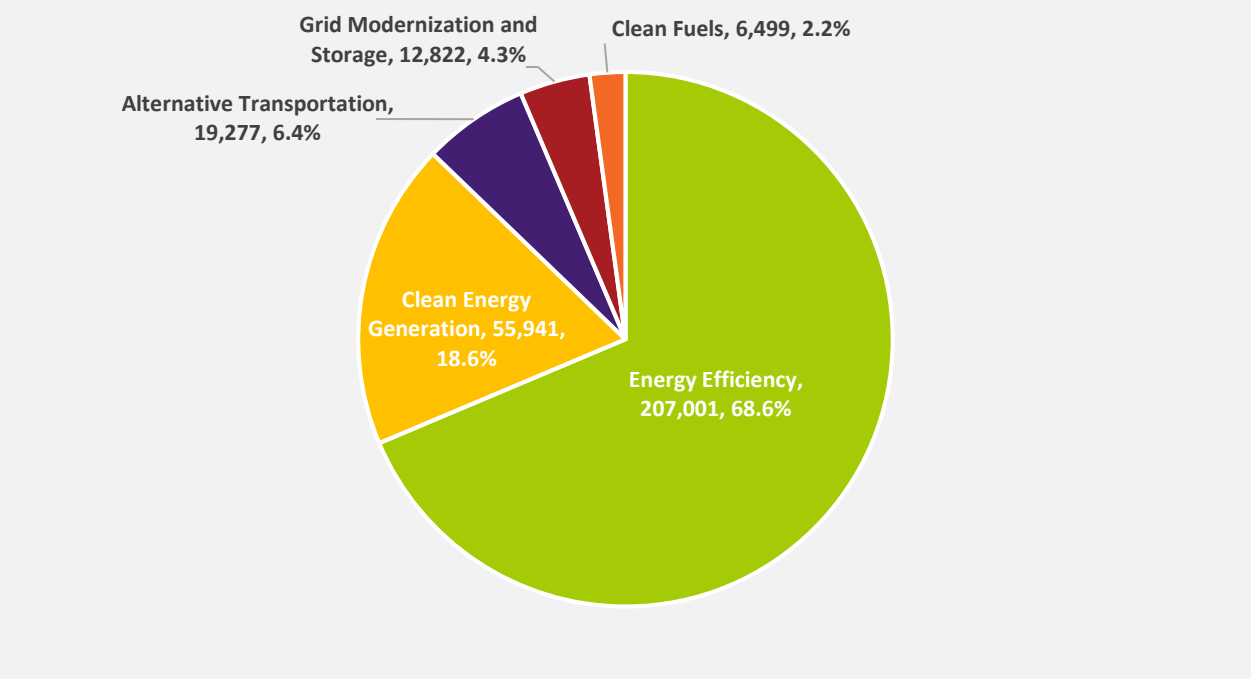
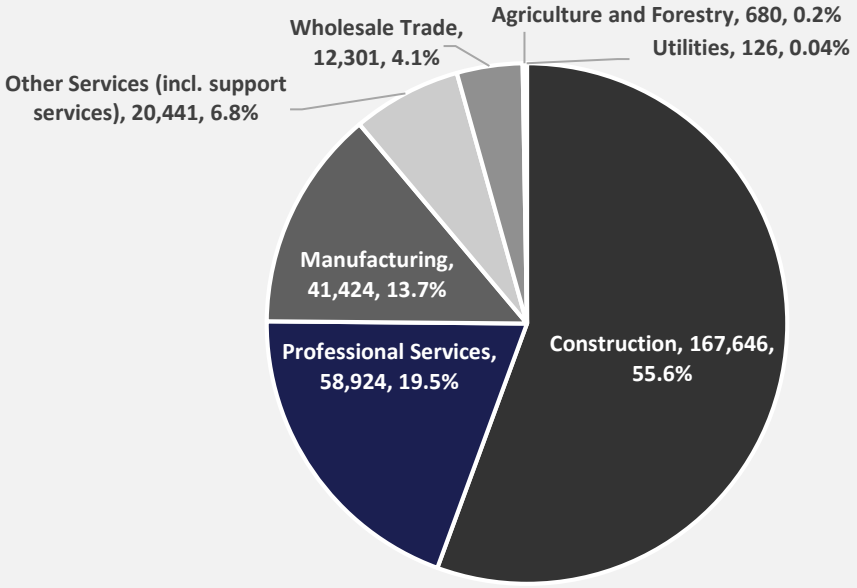


FIGURE 5. ALLIANCE STATES' COVID-19 CLEAN ENERGY JOB LOSSES BY VALUE CHAIN SEGMENT, MARCH-AUGUST 2020

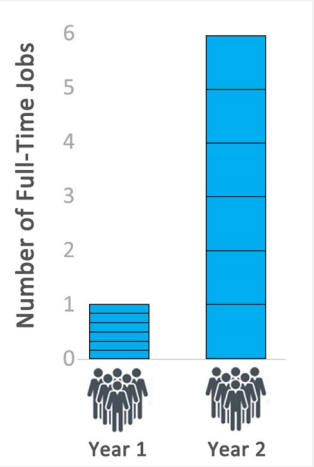


FULL-TIME EQUIVALENT CLEAN ENERGY EMPLOYMENT

Full-time equivalent (FTE) clean energy jobs are used to identify the concentration, or intensity, of clean energy activity. For the purposes of this report, an individual is counted as a clean energy worker if they spend any amount of their work week or labor hours on clean energy-related activities. Over time, as clean energy policies and fiscal incentives increase the demand for clean energy goods and services in a state, a clean energy worker that previously only spent a quarter of the work week installing high-efficiency HVAC technologies may now be spending more than half to all of their labor hours on energy efficiency-related services. This increase in the number of labor hours dedicated to clean energy services is captured through the FTE metric.[19]

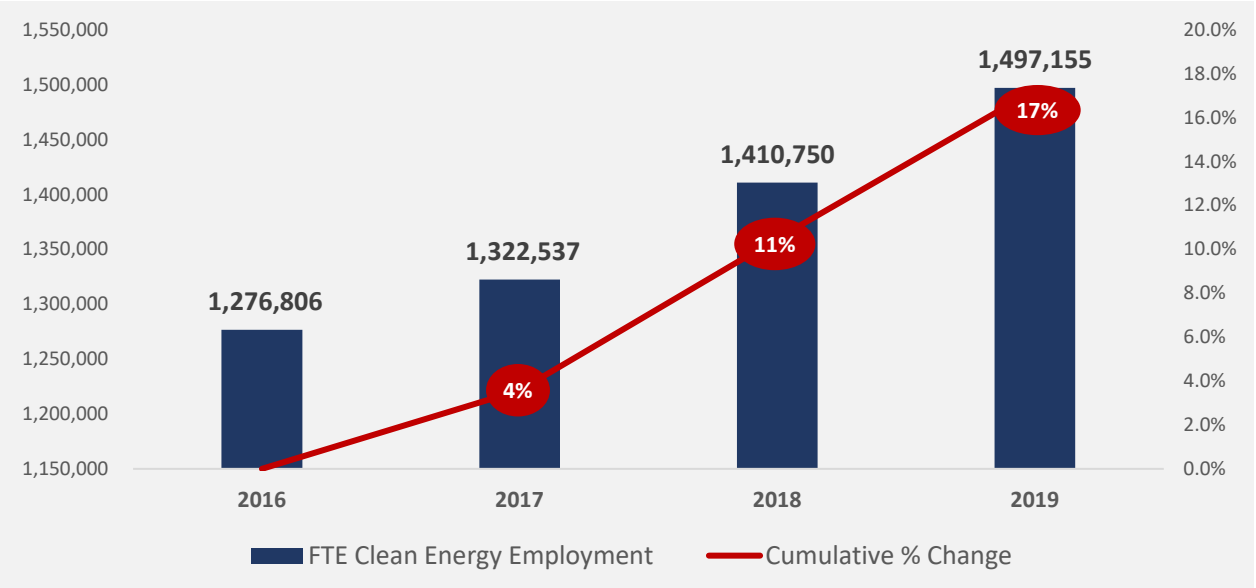
[19] These jobs were extrapolated using a combination of state-level and census region data. The data were adjusted based on revenue distribution by technology and each job is weighted according to how much time workers were reported to spend on clean energy activities (1-49 percent, 50-99 percent, or 100 percent). For a full description of this methodology, please refer to Appendix D.

An example can illustrate the importance of tracking FTE clean energy employment. If an HVAC firm had 6 installers in 2018 who occasionally installed heat pumps, and now has 6 installers who exclusively do so, there would be no change in the total number of clean energy workers reported. However, because the number of labor hours working with heat pumps has increased, FTE jobs would show a corresponding increase.



At the end of 2019, seven in ten (70 percent) clean energy workers spent all of their labor hours on clean energy-related activities across the Alliance states; this represented an increase from about 64 percent in 2016. In total, FTE clean energy jobs across the Alliance states grew by 17 percent between 2016 and 2019. There were 220,348 more FTE clean energy workers across the Alliance states at the end of 2019 compared to 2016.

FIGURE 6. ALLIANCE STATES' FTE CLEAN ENERGY EMPLOYMENT TOTALS, 2016-2019



Clean Energy Value Chain Employment

The following section provides a crosscut of clean energy jobs by value chain activity, identifying what types of clean energy functions—like production, installation, or sales—are particularly concentrated in the Alliance states. In general, the Alliance states' policies and programs are focused on clean energy and energy efficiency deployment, and this is reflected in the concentration of construction workers. Table 2 below provides more detail on the most common types of occupations that are found in each industry or value chain sector.[20]

TABLE 2. TYPES OF OCCUPATIONS BY VALUE CHAIN SECTOR

Industry/Value Chain Sector	Types of Occupations
Construction	Carpenters; Heating, Ventilation, and Air Conditioning (HVAC) Mechanics or Installers; Electricians; Solar Photovoltaic Installers
Professional Services	Engineers; Managers; Financial Analysts; Consultants; Computer Programmers
Manufacturing	Assemblers and Fabricators; Welders; First-Line Supervisors of Production and Operating Workers; Metal and Plastic Workers
Wholesale Trade	Sales Representatives (Wholesale and Manufacturing); First-Line Supervisors of Sales Workers
Utilities	Power Plant Operators; Power Distributors and Dispatchers; Electrical Power-Line Installers and Repairers
Agriculture	Farmworkers and Laborers; Agricultural Equipment Operators; First-Line Supervisors of Farming and Forestry Workers
Other Services	Automotive Service Technicians and Mechanics; Automotive Body and Related Repairers

[20] It should be noted that these are only a sample of the most common jobs found in each industry sector. However, because an industry sector's staffing patterns covers many different occupational groups, there could also be sales workers and customer service representatives in the construction industry or electricians, installers, and repairers in the utilities industry.

In the Alliance states, about four in ten clean energy workers (43 percent) were in the construction trades; this industry—which includes residential and industrial building construction, utility system construction, and building contractors—accounted for 925,426 clean energy jobs as of the last quarter of 2019. Specific occupations that conduct clean energy-related construction work include carpenters, electricians, welders, insulation and weatherization workers, HVAC workers, or installation, maintenance, and repair technicians. The prevalence of clean energy construction jobs in the Alliance states indicates that much of the clean energy activity in these regions is focused on deployment and installation of clean energy technologies as opposed to, for example, wholesale trade and distribution or manufacturing. The energy efficiency sector in particular is largely comprised of construction workers. In fact, the Alliance states have strong building and appliance efficiency standards and policies.

Following construction, just under a quarter of the Alliance states' clean energy labor force was engaged in professional service occupations (23 percent), including engineering, finance, accounting, research and analytics, or legal support. Manufacturing accounted for about 16 percent of jobs, or roughly 346,220 workers. Pennsylvania, which just joined the U.S. Climate Alliance in 2019, already had a significant number of ENERGY STAR product manufacturing plants. As of 2017, the state was home to 81 manufacturers of ENERGY STAR-certified products and 83 companies building ENERGY STAR-certified homes, three of which were committed to building 100 percent ENERGY STAR-certified homes.[21] Additionally, California is home to the Tesla electric vehicle manufacturing plant, as well as Tesla Gigafactories in both Nevada and New York manufacturing battery storage and solar modules.[22]

The remainder of clean energy jobs in the Alliance states are found across wholesale trade[23], utilities, agriculture, and forestry[24], and other services.[25] For specific information on how clean energy value chain activity varies by technology sectors such as energy efficiency or clean energy generation, please refer to the Clean Energy Sector Employment section of this report.

[21] Pennsylvania ENERGY STAR Fact Sheet, April 2017. Accessed April 2020. https://www.energystar.gov/sites/default/files/asset/document/Pennsylvania_2017.pdf.

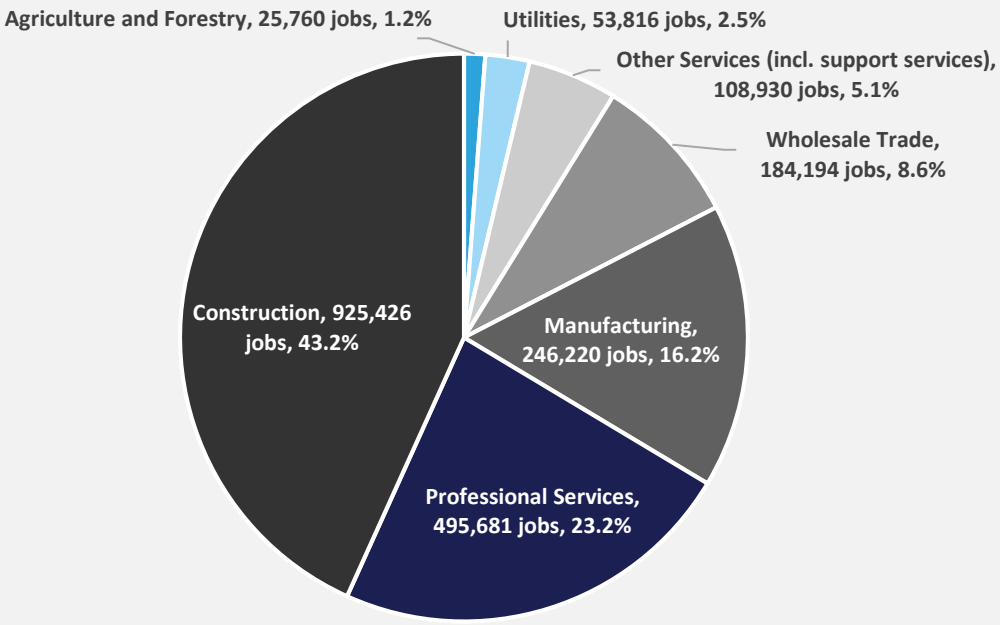
[22] https://www.tesla.com/gigafactory2

[23] The sales and distribution of clean energy goods to retailers; industrial, commercial, or institutional organizations; or other wholesalers. This explicitly excludes direct retail sales to consumers.

[24] Agriculture and forestry workers include those individuals that are engaged in the harvesting of clean fuels such as woody biomass or corn ethanol.

[25] Other services are mostly comprised of automotive repair and maintenance, but also includes business, professional, labor, political, and similar organizations such as social advocacy organizations, business associations, labor unions, or political organizations.

FIGURE 7. ALLIANCE STATES' CLEAN ENERGY EMPLOYMENT BY VALUE CHAIN, 2019



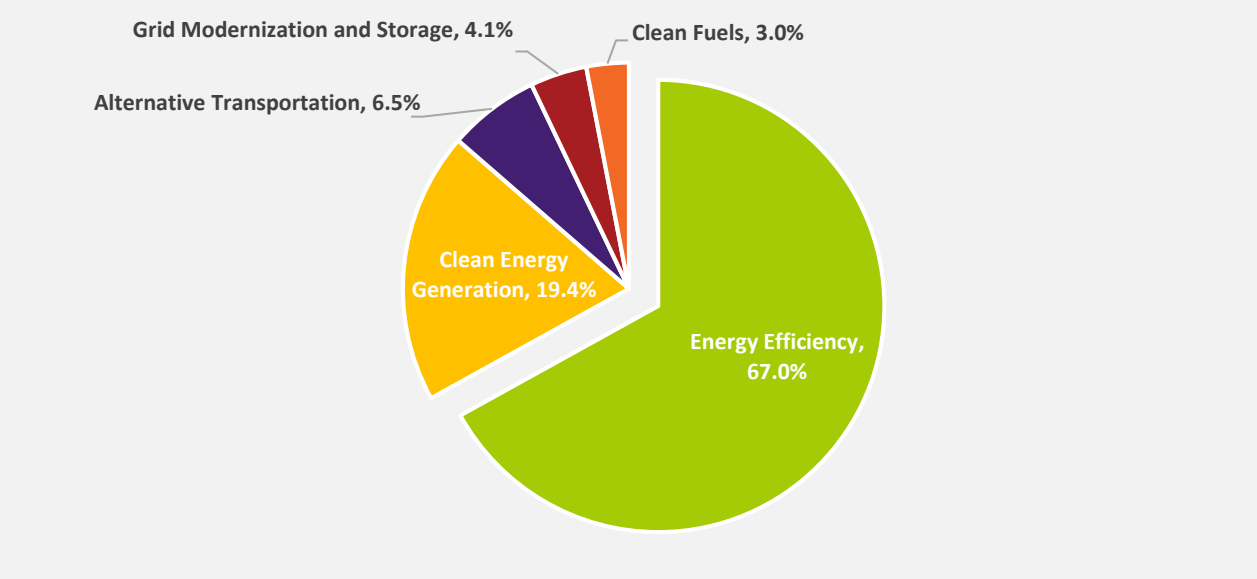
Clean Energy Technology Sector Employment

ENERGY EFFICIENCY

Energy efficiency is an important component of GHG emissions reductions and is also one of the fastest growing segments of the clean energy labor market in the Alliance states. According to the American Council for an Energy-Efficient Economy (ACEEE), energy efficiency could reduce energy-related carbon emissions in the United States by as much as 57 percent by 2050, and these low-cost measures would generate overall energy savings worth more than $700 million over the next three decades.[26]

Collectively, the Alliance states accounted for 17 of the top 20 ranked states by the ACEEE in 2019 and 70 percent of nationwide investments in utility-driven energy efficiency improvements in 2018.[27] Across the Alliance states, the energy efficiency sector was the largest component of clean energy jobs at the end of 2019. In total, the energy efficiency workforce accounted for 67 percent of all clean energy jobs in the Alliance states—over 1.43 million workers. Energy efficiency firms also exhibited the highest absolute growth since 2016, adding about 109,300 new jobs, for an overall growth rate of just over eight percent in three years.

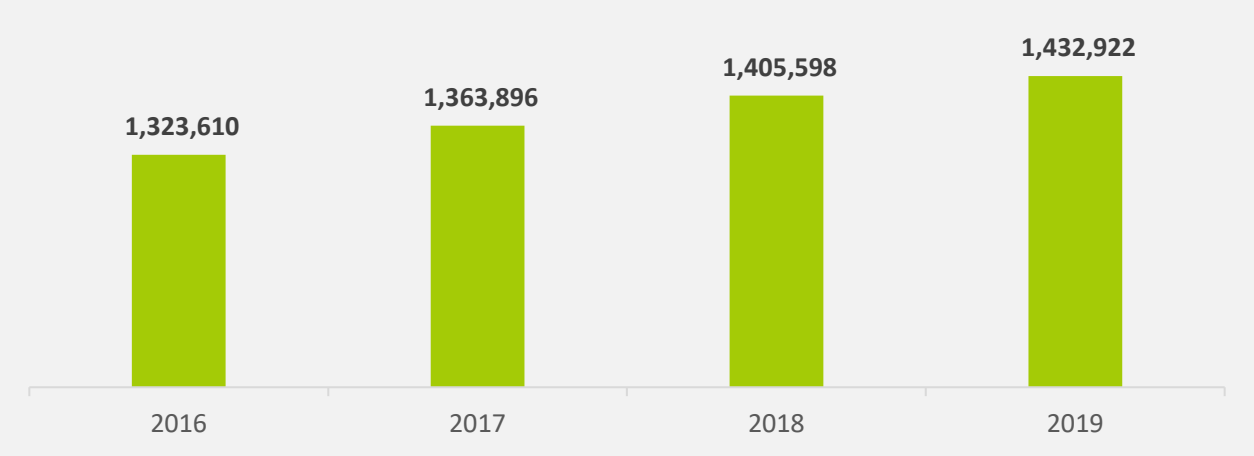
FIGURE 8. ENERGY EFFICIENCY PROPORTION OF CLEAN ENERGY JOBS, 2019



[26] Nadel, Steven and Lowell Ungar. Halfway There: Energy Efficiency Can Cut Energy Use and Greenhouse Gas Emissions in Half by 2050. ACEEE. September 2019.

[27] United States Climate Alliance, 2019 Annual Report. Ranking developed by the American Council for an Energy-Efficient Economy (ACEEE) 2019 Scorecard. Investments data from the U.S. Energy Information Agency, Annual Electric Power Industry Report.

FIGURE 9. ALLIANCE STATE TOTAL ENERGY EFFICIENCY EMPLOYMENT, 2016-2019



Alliance states such as California and Washington have implemented aggressive energy efficiency goals for all new building construction as well as large commercial buildings. Other Alliance states are similarly leading the way with energy efficiency programs that have set energy efficiency resource standards for utilities, targets for the improved efficiency of government buildings, energy and water appliance standards, energy retrofits for low-income housing, and electric utility waste reductions.

Energy efficiency upgrades, installations, and retrofits also tend to be a job creator, as much of energy efficiency work is concentrated in the construction industry—a more labor-intensive industry compared to manufacturing, for example.[28] In other words, more workers are typically required to complete an energy efficiency construction project, like the weatherization of a home or retrofit of an entire building, compared to the manufacture of an ENERGY STAR product. Such energy efficiency upgrades, particularly related to indoor air and temperature quality, will be of particular importance given the current realities of COVID-19 and related stay-at-home orders and behaviors, as many studies suggest that building air quality and temperature directly impact both individual health and student learning outcomes.[29]

Across the Alliance states, energy efficiency construction accounted for over half (52 percent) of all energy efficiency jobs, or 743,163 workers at the end of 2019 (see Figure 11). The abundance of energy efficiency construction jobs suggested that the majority of energy efficiency activity in the Alliance states is concentrated in the deployment of energy-efficient technologies and services.

Overall, energy efficiency workers in the Alliance states were more likely to spend their labor hours working with heating, ventilation, and air conditioning (HVAC) systems, efficient lighting technologies, and ENERGY STAR appliances (see Figure 10). Traditional HVAC was the largest sub-sector at the end of 2019; these jobs comprised

[28] American Council for an Energy-Efficient Economy. How Does Energy Efficiency Create Jobs? November 2011. https://www.aceee.org/files/pdf/fact-sheet/ee-job-creation.pdf

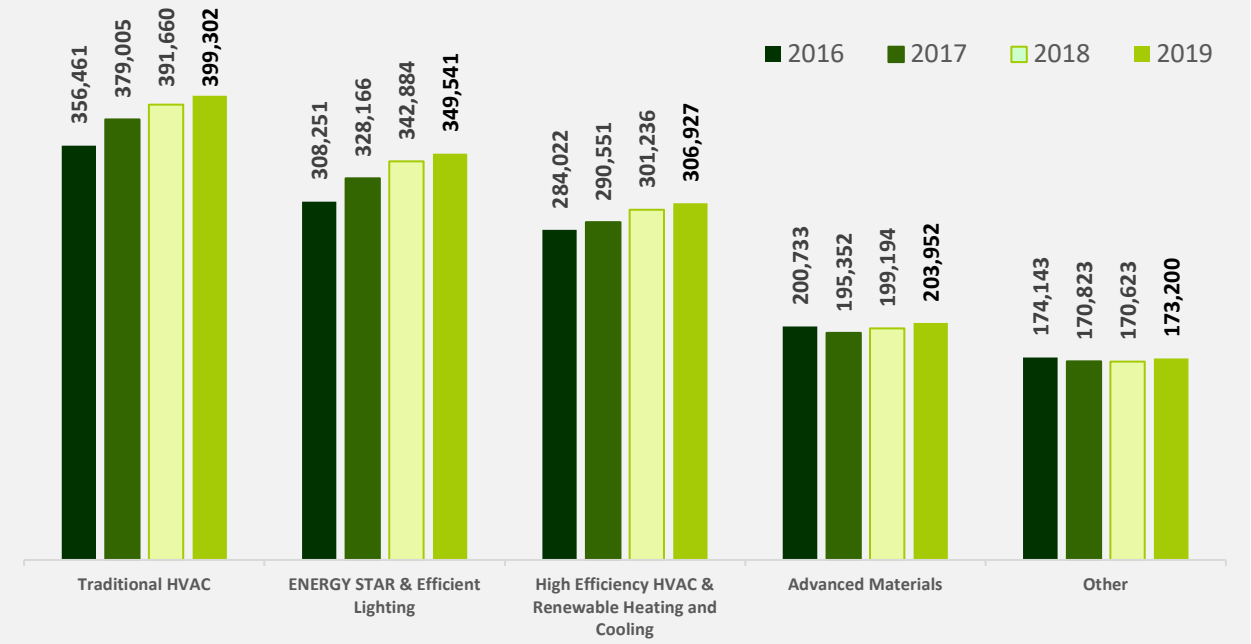
[29] *See generally:* https://hechingerreport.org/the-learning-effect-of-air-quality-in-classrooms/; https://www.epa.gov/iaq-schools/indoor-air-quality-high-performance-schools; https://www.epa.gov/report-environment/indoor-air-quality; https://www.neefusa.org/health/asthma/national-public-health-week-health-impacts-indoor-air-quality

about 28 percent of all energy efficiency workers. In total, there were 399,302 traditional HVAC workers across the Alliance states, and this workforce grew by 12 percent, or about 42,800 workers, between 2016 and 2019.

Following traditional HVAC, ENERGY STAR and efficient lighting technologies employed the second largest number of workers within the energy efficiency sector; these technologies accounted for just under a quarter (24 percent) of the energy efficiency labor force and grew by just over 13 percent or 41,300 workers from 2016 through 2019. The high efficiency HVAC and renewable heating and cooling sub-sector accounted for about 21 percent of the energy efficiency labor market and grew by eight percent, or 22,900 workers in three years. The remaining two sectors—advanced materials and other energy-efficient technologies[30]—together constituted just over a quarter (26 percent) of energy efficiency jobs.

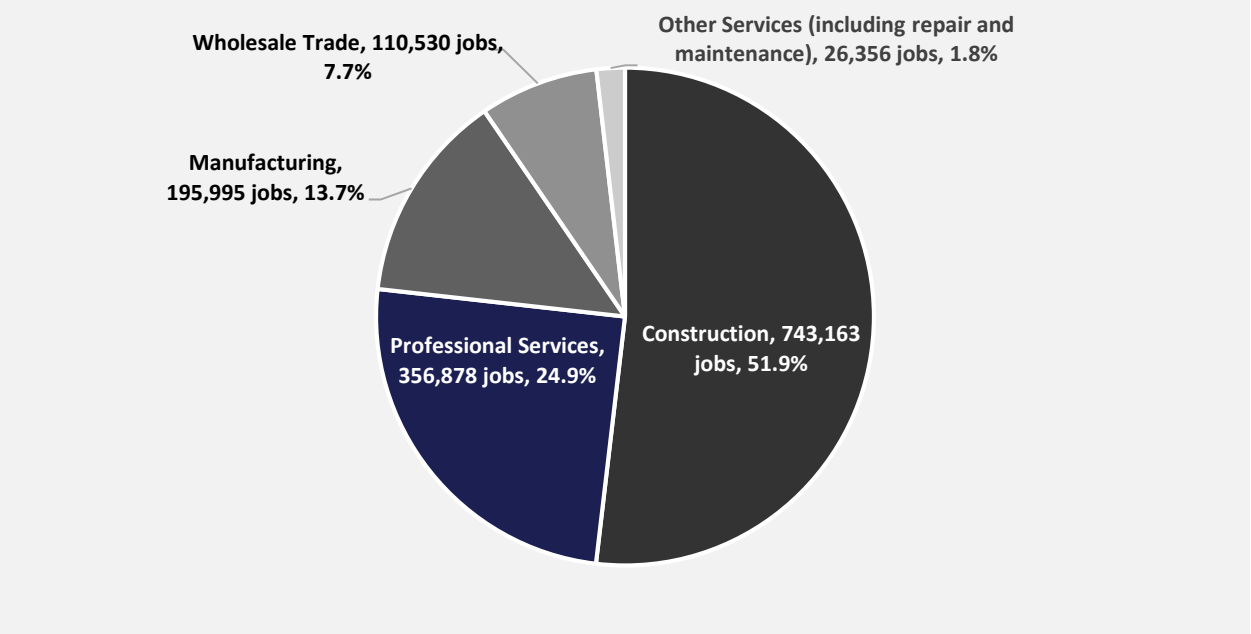
It is important to note the difference between traditional HVAC and high efficiency HVAC workers. Energy efficiency workers fall within the traditional HVAC category if they spent most of their labor hours installing or servicing traditional and non-efficient HVAC technologies, but also spent at least a portion—though less than a majority—of their time on efficient HVAC goods and services. Conversely, an individual would be counted as a high-efficiency HVAC worker if they spent the majority of their labor hours working with efficient HVAC technologies and the remainder, if any at all, on traditional HVAC technologies.

FIGURE 10. ALLIANCE STATE ENERGY EFFICIENCY EMPLOYMENT BY SUB-TECHNOLOGY, 2016-2019



[30] Other energy efficiency includes variable speed pumps, other design services, consulting, software, policy, and non-profit work not specific to a detailed technology as well as energy auditing, rating, monitoring, metering, and leak detection, LEED certification, and phase-change materials.

FIGURE 11. ALLIANCE STATE ENERGY EFFICIENCY EMPLOYMENT BY VALUE CHAIN, 2019



CLEAN ENERGY GENERATION

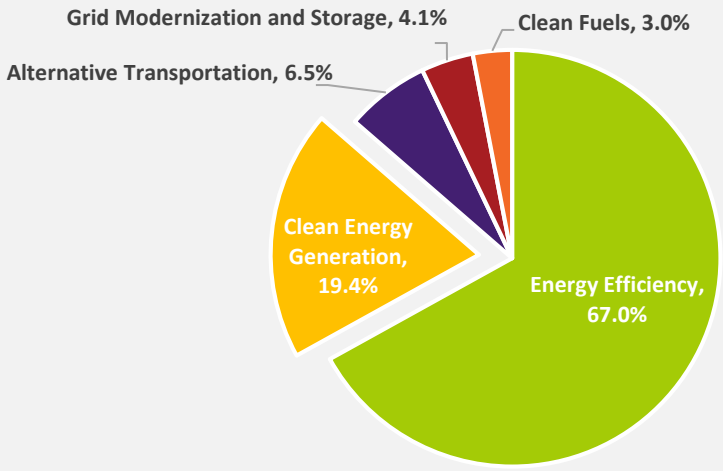
The Alliance states exhibit strong commitments to achieving zero-carbon electricity production. Over the last two decades, electricity generation across the Alliance states has been shifting away from coal and towards renewable electricity. Between 2000 and 2018, coal generation in the Alliance states declined by 51 percent[31], compared to a 37 percent decline for non-Alliance states. At the same time, renewable generation capacity from wind, solar, biomass, landfill gas/municipal solid waste, and geothermal resources grew by 457 percent between 2005 and 2018—an increase of 56 gigawatts (GW).[32] States like Hawaii, California, Puerto Rico, New Mexico, Washington, Virginia, and New York have all passed legislation requiring 100 percent carbon-free electric power generation by no later than 2050, and many other states have adopted 100 percent zero-carbon electricity goals.[33] Alliance states are also initiating large scale procurements of renewable energy and investing in grid modernization.

[31] U.S. Energy Information Administration. Detailed State Data. Net Generation by State by Type of Producer by Energy Source. Latest Revision March 2020. Data Accessed April 2020.

[32] A gigawatt is a unit of power equal to one billion watts. Data sourced from the U.S. Energy Information Administration and the United States Climate Alliance 2019 Annual Report.

[33] United States Climate Alliance, 2020 Annual Report: https://www.usclimatealliance.org/annual-report.

FIGURE 12. CLEAN ENERGY GENERATION PROPORTION OF CLEAN ENERGY JOBS, 2019



In the last quarter of 2019, clean energy generation jobs accounted for 415,613 workers in the Alliance states across sub-sectors such as solar, wind, nuclear, traditional and low-impact hydropower[34], bioenergy and combined heat and power, and geothermal generation. These workers were largely found in the construction industry, which accounted for 139,609 jobs or roughly one-third of renewable energy employment (34 percent). Clean energy generation construction workers are typically engaged in solar installation and facility or turbine construction while the remainder of the workforce includes individuals that support wholesale parts distribution, equipment and parts manufacturing, or professional services such as consulting, finance, administrative, and legal support.

Clean energy generation professional services supported 99,145 jobs at the end of 2019—just under a quarter of this sector's workforce (24 percent), while the manufacturing industry supported about 15 percent of Alliance states' clean energy jobs—or 63,800 workers. Meanwhile, clean energy generation utility workers accounted for almost 13 percent of jobs at the end of 2019 (see Figure 15).

Overall, clean energy generation jobs declined by four percent from a high of almost 433,000 workers in 2016. These declines were largely the result of losses in the solar and nuclear power generation workforce, which together shed just over 37,000 jobs in three years, and to a smaller extent declines in traditional hydropower generation employment.

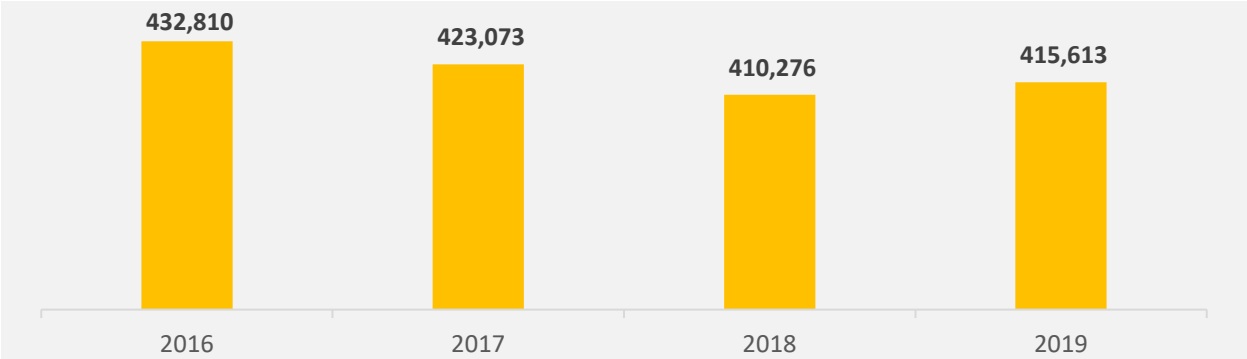
Shrinking nuclear generation employment for the Alliance states follows a long-running trend of general declines in nuclear generation capacity both nationally and within the Alliance states. Between 2005 and 2018, nuclear generation across the Alliance states declined by just over three percent[35], and few Alliance states explicitly

[34] Low-impact hydroelectric generation is similar to traditional, but certification criteria are aimed at ensuring that the certified dam adequately protects or mitigates its impacts in eight key resources areas, including river flows, water quality, fish passage and protection, watersheds, threatened and endangered species, cultural resources, and public access and recreation opportunities. The eighth criterion requires that the dam not have been recommended for removal (LIHI – Low Impact Hydropower Institute).

[35] U.S. Energy Information Administration. Form EIA860, Released September 2019.

incentivize nuclear power generation. Since 2016, the nuclear electric power generation sub-sector shed just over 4,000 jobs across the Alliance states, a decline of nearly 11 percent in three years. At the same time, job losses in the traditional hydropower sub-sector amounted to 959 jobs in three years—a three percent decline between 2016 and 2019. However, alongside losses in traditional hydropower, low-impact hydropower jobs grew by 37 percent, or 2,103 jobs.

FIGURE 13. ALLIANCE STATE TOTAL CLEAN ENERGY GENERATION EMPLOYMENT, 2016-2019



Solar jobs were the largest component of the clean energy generation workforce across the Alliance states, with particularly high concentrations of workers in California, Massachusetts, New York, Nevada, North Carolina, and Colorado. Across all 24 states, there were a total of 254,172 solar jobs in 2019. California in particular has been a long-time leader of the national solar market. Since 2006, the California Solar Initiative has contributed $3.3 billion in rooftop solar investments, incentivizing the development of almost 1,900 megawatts of solar capacity across the state. North Carolina is second in the nation in terms of installed solar capacity and the state has been working to double this capacity over the last several years. Similarly, Massachusetts continues to ramp up solar energy deployment through its Solar Massachusetts Renewable Target (SMART) program. To date, the state has enough solar installed to power 489,397 homes.[36] At the same time, New York's solar generation capacity has grown by more than 1,200 percent since 2012 with a cumulative six gigawatts of solar required by 2025.[37] In total, as of 2018, the Alliance states accounted for 70 percent of total nationwide solar capacity.[38]

Due in large part to the maturation of solar markets, increased installation efficiency has resulted in fewer workers per installed megawatt. At the same time, the shift away from direct door-to-door residential sales campaigns to retail and online sales for large companies like Tesla (formerly SolarCity) has additionally led to some declines in the solar jobs. While solar capacity was increasing prior to COVID-19, solar jobs declined by 33,000 workers in the Alliance states—roughly 12 percent in three years. Between 2018 and 2019 however, solar jobs in the Alliance states rebounded from 251,530 workers to 254,172 workers, an increase of 2,642 jobs or about one percent in 12 months. This mirrors the overall nationwide solar employment trends; between 2016 and 2019, solar jobs declined by 7.6

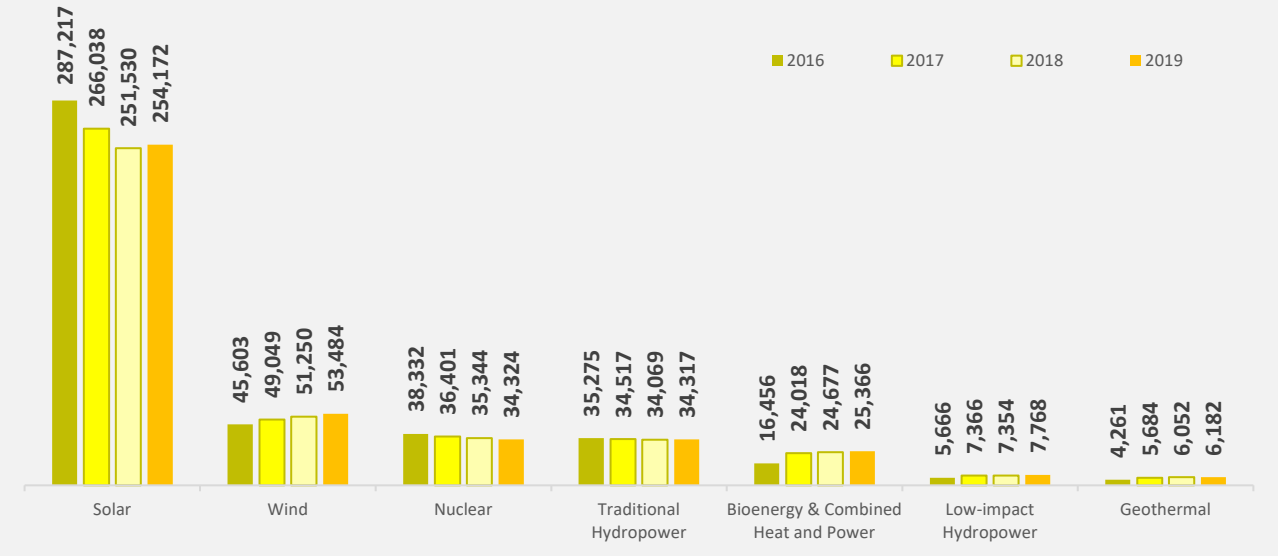
[36] Solar Energy Industries Association: https://www.seia.org/state-solar-policy/massachusetts-solar.
[37] New York Statewide Solar Projects: https://www.nyserda.ny.gov/All-Programs/Programs/NY-Sun/Solar-Data-Maps/Statewide-Projects.
[38] United States Climate Alliance, 2019 Annual Report.

percent across the United States but saw a three percent growth rate between 2018 and 2019. Of the 24 Alliance states, 14 states saw declines in solar jobs from 2016 through 2019.[39] Declines in the solar workforce may be attributed to shifting business models, as many solar companies have moved away from door-to-door sales. Of the remaining Alliance states that witnessed solar jobs grow over this time period, Minnesota and Illinois had the greatest absolute growth in jobs with the addition of a respective 1,127 and 592 solar workers.

Though solar jobs represented the majority of the clean energy generation sector in the Alliance states at the end of 2019, bioenergy and wind energy generation also created many jobs between 2016 and 2019. Wind generation employment grew by about 17 percent between 2016 and 2019, adding another 7,881 jobs to the clean energy labor force. In fact, the Alliance states accounted for 60 percent of all new wind jobs in the country over these three years. Bioenergy and combined heat and power created just over 8,900 new jobs since 2016, for a growth rate of 54 percent. This job growth comes alongside state-level policies to support the inclusion of biomass and offshore wind power in renewable energy portfolios. California, for instance, has six pilot projects running that inject biomethane from dairy digesters into the state's natural gas pipelines and eight out of the 24 Alliance states have policies specific to offshore wind energy procurement.[40] Accordingly, between 2005 and 2018, the Alliance states saw respective increases in wind and biomass generation capacity.[41]

While geothermal energy generation accounted for just under two percent of total clean energy generation jobs in the Alliance states, the sub-sector grew by just over 1,900 workers in three years—a growth rate of 45 percent. As of the last quarter of 2019, there were almost 6,200 geothermal energy generation workers in the Alliance states. Currently, five Alliance states have geothermal-specific incentives, including Delaware, Michigan, Montana, New Mexico, and Pennsylvania.[42]

FIGURE 14. ALLIANCE CLEAN ENERGY GENERATION EMPLOYMENT BY SUB-TECHNOLOGY, 2016-2019



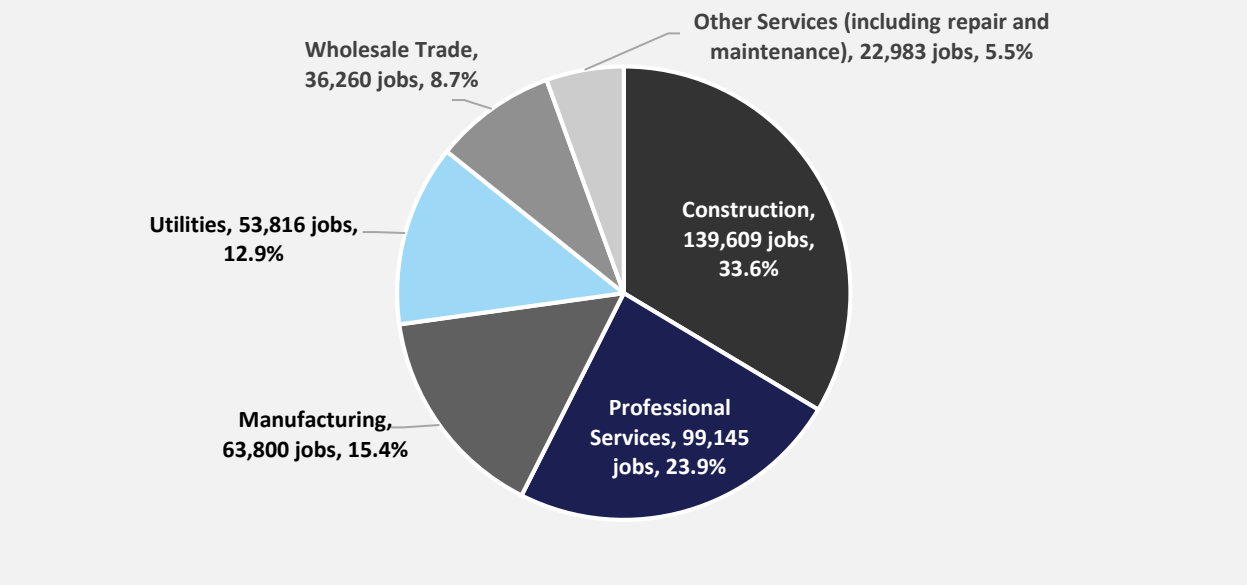
[39] The following states so an increase in solar jobs from 2016 through 2019: Montana, Minnesota, Delaware, Illinois, Pennsylvania, Virginia, Colorado, Maine, New York, and New Jersey.

[40] United States Climate Alliance, 2019 State Factsheets.

[41] United States Climate Alliance, 2019 Annual Report.

[42] *Id.*

FIGURE 15. ALLIANCE CLEAN ENERGY GENERATION EMPLOYMENT BY VALUE CHAIN, 2019



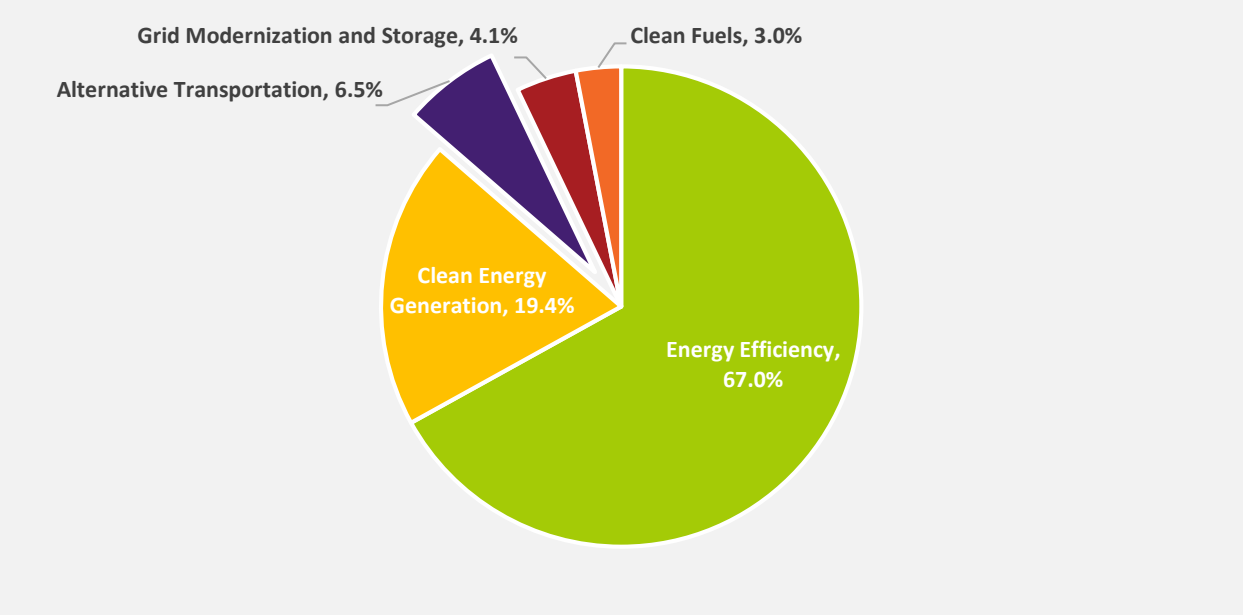
ALTERNATIVE TRANSPORTATION

As of 2017, the transportation sector accounted for 28.9 percent of domestic GHG emissions—the largest source of GHG emissions in the United States. Since 2000, nationwide transportation emissions declined by less than two percent, making the transportation sector a significant and important area to tackle as the Alliance states aim to reduce their GHG emissions.[43]

Overall, there have been steady gains in decarbonizing the U.S. transportation fleet, as annual hybrid and plug-in electric vehicle sales have skyrocketed over the last decade. In 2019, total hybrid electric vehicle sales were 50 percent higher compared to 2011, while plug-in electric vehicle sales increased six-fold.[44] The Alliance states alone accounted for just over 80 percent of all battery electric, plug-in hybrid, and fuel cell vehicles sold across the country in 2018. Alliance states are committed to putting more zero-emission vehicles (ZEVs) on their roads. Fifteen states have already adopted, or are in the process of adopting, light-duty ZEV regulations, and in July 2020, 15 Alliance states and the District of Columbia announced a joint MOU to collaborate on the creation of a self-sustaining, zero-emission medium- and heavy-duty vehicle (MHDV) market.[45]

[43] U.S. Energy Information Administration.
[44] U.S. Department of Energy. Alternative Fuels Data Center. Data accessed 10 March 2020.
[45] United States Climate Alliance, 2020 Annual Report: https://www.usclimatealliance.org/annual-report.

FIGURE 16. ALTERNATIVE TRANSPORTATION PROPORTION OF CLEAN ENERGY JOBS, 2019



Alternative transportation was the third largest clean energy job sector in the Alliance states. At the end of 2019, this sector accounted for almost seven percent of total clean energy employment. Altogether, these firms employed 139,711 workers[46] across the Alliance states, and jobs in this sector grew by about 18 percent between 2016 and 2019, or an additional 20,841 workers. Four in ten alternative transportation workers in the Alliance states were focused on automotive repair and maintenance, including general automotive repair, automotive exhaust system and transmission repair, and other automotive mechanical and electrical repair and maintenance (see "other services" in Figure 19).[47] The wholesale trade of alternative transportation vehicles and alternative transportation parts and supplies supported almost 23,000 jobs in the Alliance states, or 16 percent of the alternative transportation workforce, while professional services represented a small portion of jobs—just over three percent or 4,560 workers.

Alternative transportation manufacturing was a significant area of activity in the Alliance states. In fact, four in ten alternative transportation jobs were found in the manufacturing industry; this roughly equated to almost 56,000 workers. Examples of manufacturing jobs for the alternative transportation sector include assemblers, machine tool operators, machinists, and industrial production managers. These are typically highly-skilled individuals, as electric vehicle systems tend to be more complex than traditional internal combustion engines. It is likely that

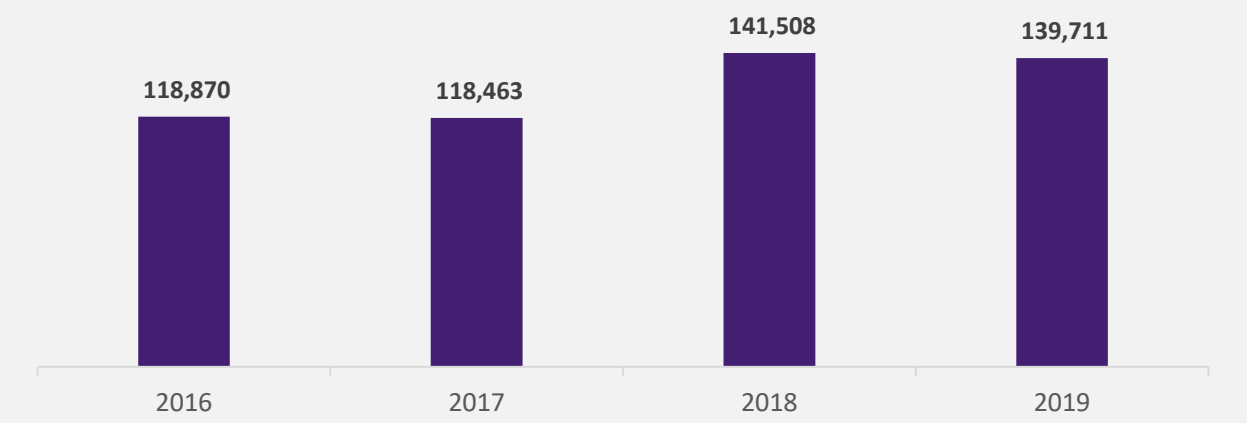
[46] Automotive retail employment such as car salesmen and car dealerships are excluded from alternative vehicle employment estimates.

[47] "Other services" is largely comprised of automotive repair and maintenance (NAICS 8111), though it can also include business, professional, labor, political, and similar organizations. The high employment total for other services is common in the alternative transportation sector, as much of the employment, outside of vehicle manufacturing and to a lesser extent wholesale trade, is concentrated in the repair and maintenance of alternative transportation vehicles.

alternative transportation manufacturing is a significant area of activity for the Alliance states as these jobs tend to be found around traditional centers of automotive manufacturing such as around the Great Lakes and the Midwest. Michigan, in particular, has a large concentration of automobile manufacturing plants and California's Tesla factory in Fremont is a significant manufacturer of electric vehicles.[48]

Indeed, the Alliance states are aware that increased deployment of ZEVs must go hand-in-hand with improved infrastructure. Because of this, Alliance states have allocated millions of dollars in funding towards electrification and transportation infrastructure improvements across their cities and towns. As of 2018, 13 Alliance states have installed about 15 percent of the public charging infrastructure necessary to support the number of plug-in electric vehicles required to meet Paris Agreement targets by 2025.[49]

FIGURE 17. ALLIANCE STATE TOTAL ALTERNATIVE TRANSPORTATION EMPLOYMENT, 2016-2019



At the end of 2019, the largest component of the alternative transportation sector was hybrid electric vehicles; this sub-sector employed just over 55,000 workers at the end of 2019. Hybrid electric vehicle companies grew their workforce by about 15 percent—or 7,273 jobs—between 2016 and 2019. Electrical vehicle companies were the second largest employer; these companies grew by 22 percent, or 8,721 additional workers from 2016 through 2019. Plug-in hybrid vehicles were also a large component of the alternative transportation sector. Companies working with this sub-technology accounted for just over 25,000 workers—a growth rate of just over 29 percent between 2016 and 2019, or roughly 5,700 new workers in three years.

The remaining alternative transportation sectors—natural gas vehicles and hydrogen and fuel cell vehicles—accounted for eight percent of the alternative transportation labor force and have either declined or grown marginally, resulting in a net loss of 850 jobs from 2016 through 2019.

[48] Hamilton, James. U.S. Bureau of Labor Statistics. Careers in Electric Vehicles. Accessed April 2020. https://www.bls.gov/green/electric_vehicles/

[49] United States Climate Alliance, 2019 Annual Report.

FIGURE 18. ALLIANCE STATE ALTERNATIVE TRANSPORTATION EMPLOYMENT BY SUB-TECHNOLOGY, 2016-2019

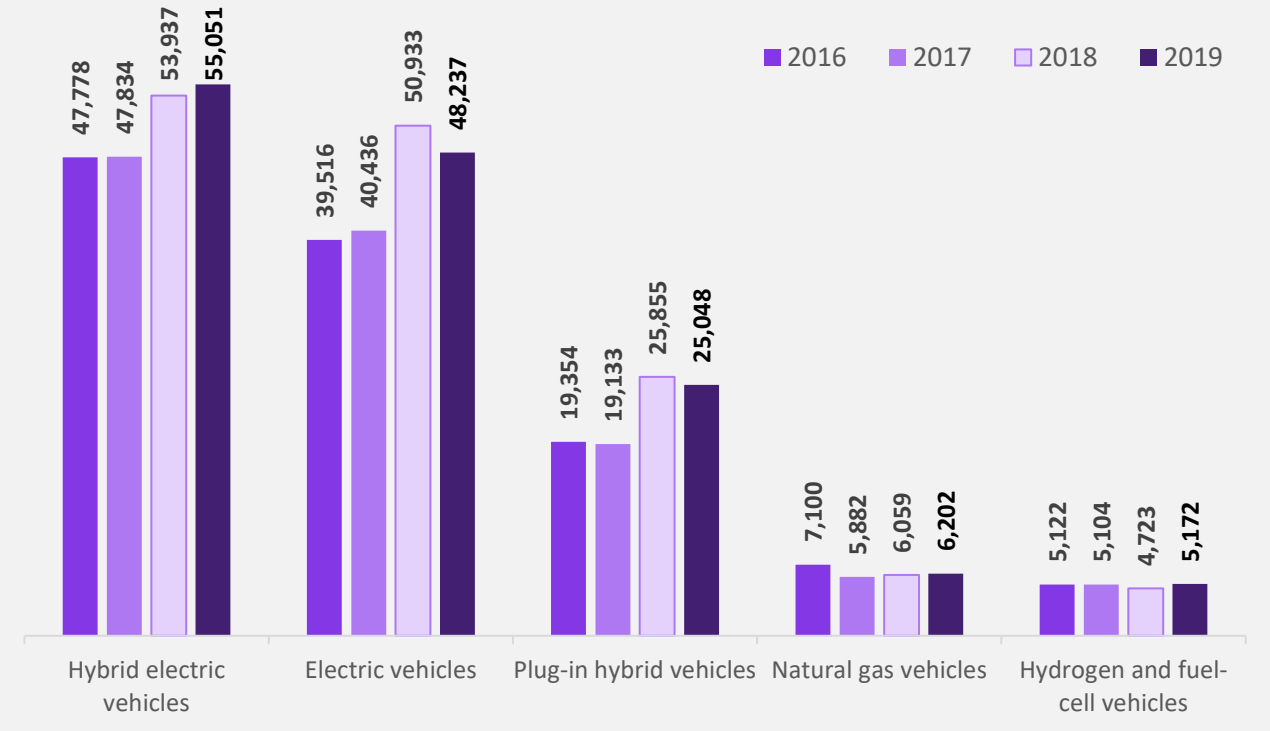
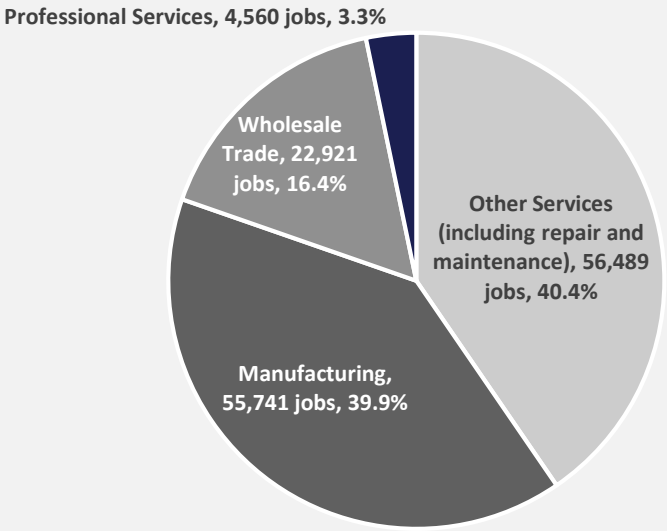


FIGURE 19. ALLIANCE STATE ALTERNATIVE TRANSPORTATION EMPLOYMENT BY VALUE CHAIN, 2019

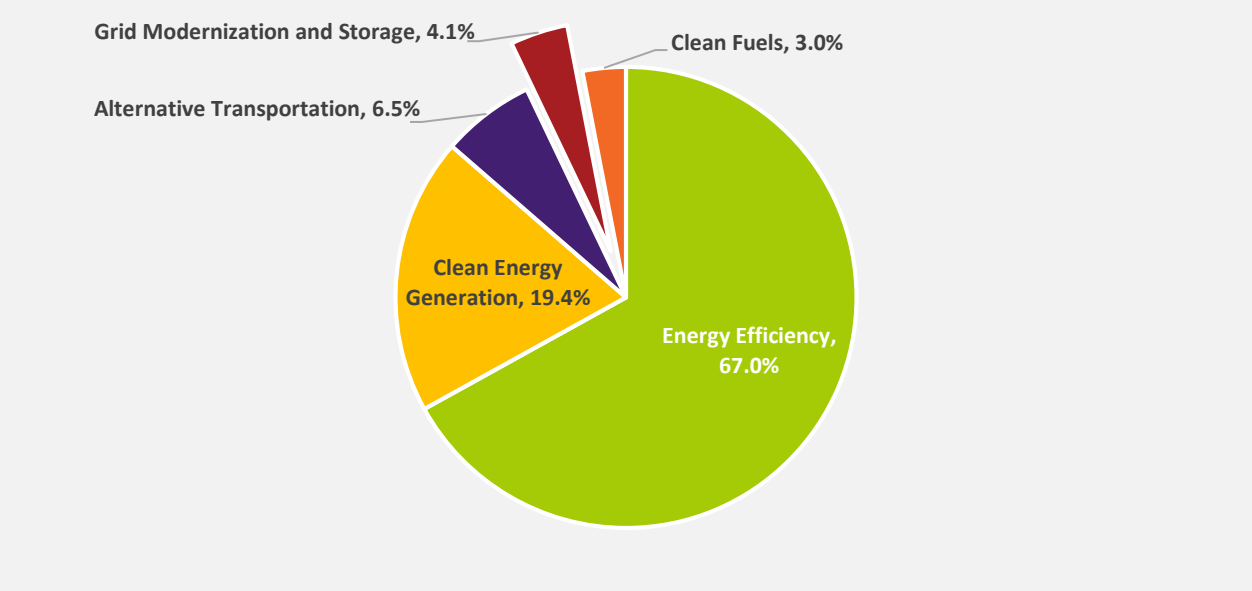


GRID MODERNIZATION AND STORAGE

New smart grid and microgrid capabilities are modernizing America's energy infrastructure, improving resiliency, consumption management, building controls, waste reduction, and storage capacities.[50] The importance of grid modernization is also connected to the more dynamic needs of a cleaner, more distributed electricity generation mix.

States across the country are pursuing a number of grid modernization activities, like policy adoption, utility reform, deployment, research and development. According to the N.C. Clean Energy Technology Center, Alliance states (California, Colorado, Hawaii, Minnesota, New York, North Carolina, and Virginia) represented seven out of the top 10 states most actively modernizing their grids as of 2019.[51] At the same time, New Jersey and Puerto Rico are developing microgrids to improve their grid resiliency, while Washington has invested $10.6 million in grid modernization funding.[52]

FIGURE 20. GRID MODERNIZATION AND STORAGE PROPORTION OF CLEAN ENERGY JOBS, 2019



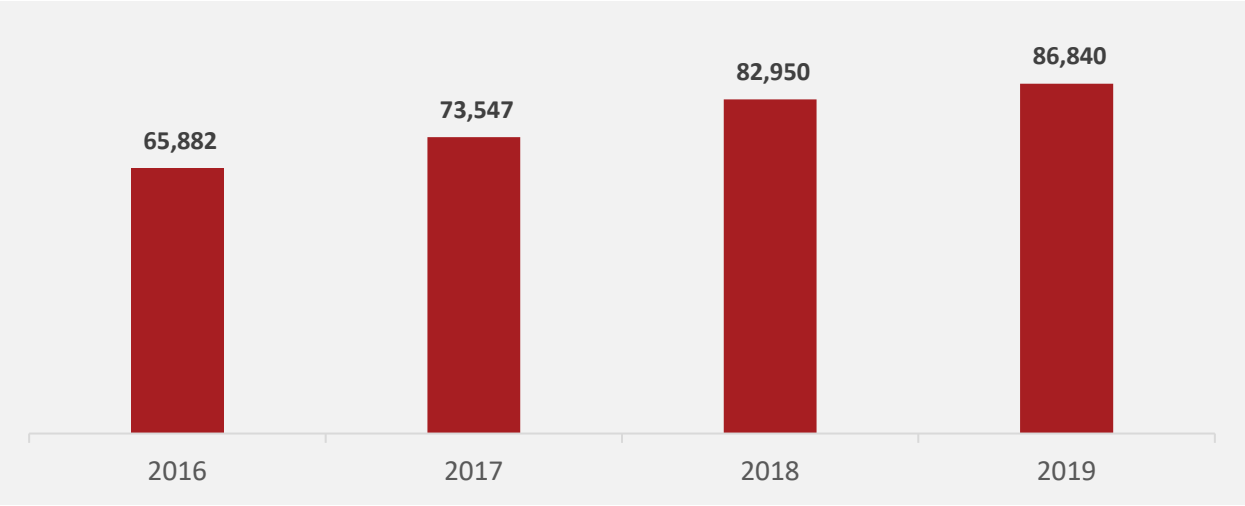
[50] *See generally:* U.S. Department of Energy, Office of Electricity Delivery and Energy Reliability.
[51] NC Clean Energy Technology Center. 50 States of Grid Modernization, Q1 2019 Quarterly Report, May 2019.
[52] United States Climate Alliance, 2019 State Factsheets.

As Alliance states move towards 100 percent renewable energy generation capacity, there may also be an increased need for energy storage capabilities. The Alliance states host 13 of the 18 operating battery energy storage sites with an installed power capacity of roughly 20 MW or greater across the nation. In fact, the Alliance states accounted for 65 percent of all operating energy storage capacity at the end of 2018.[53]

Grid modernization and storage firms represented 86,840 clean energy workers at the end of 2019. Between 2016 and 2019, this clean energy sector grew by 31.8 percent, or nearly 21,000 additional workers. As with clean energy generation and energy efficiency, much of employment for grid modernization and storage firms was found in construction, professional services, and manufacturing. Construction firms accounted for almost half of the Alliance states' grid modernization and storage workers—roughly 42,700 jobs—followed by professional services with about 24 percent of jobs and manufacturing with almost 19 percent of employment (see Figure 23).

Storage was the largest sub-sector, accounting for about 54,000 jobs, or 62 percent of the overall grid modernization and storage sector at the end of 2019.[54] Altogether, storage jobs grew by 37 percent, creating 46,668 new jobs between 2016 and 2019. In fact, all grid modernization and storage subsectors grew over this time period, with microgrid technologies increasing employment by about 36 percent (3,300 additional jobs), while smart grid technologies experienced a 37 percent growth (2,700 additional jobs) and other grid modernization technologies grew by approximately three percent (270 jobs). A particular strength in the Alliances states' clean storage sector is Tesla's Gigafactories in Nevada and New York, which is a lithium-ion and electric vehicle subassembly factory, supplying battery packs for electric vehicles and stationary storage systems.

FIGURE 21. ALLIANCE STATE TOTAL GRID MODERNIZATION AND STORAGE EMPLOYMENT, 2016-2019



[53] United States Climate Alliance, 2019 Annual Report.

[54] Clean storage jobs encompass the following sub-technologies: pumped hydro-power storage, battery storage, mechanical storage, thermal storage, biofuels, and nuclear fuel.

FIGURE 22. ALLIANCE STATE GRID MODERNIZATION AND STORAGE EMPLOYMENT BY SUB-TECHNOLOGY, 2016-2019

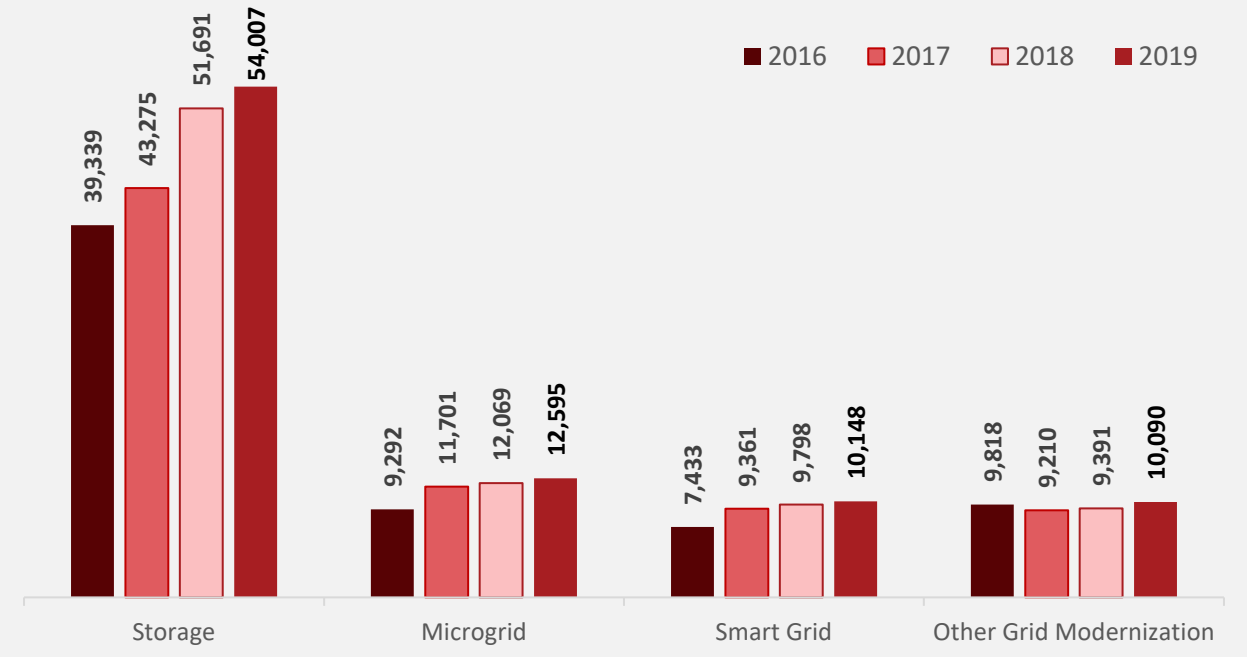
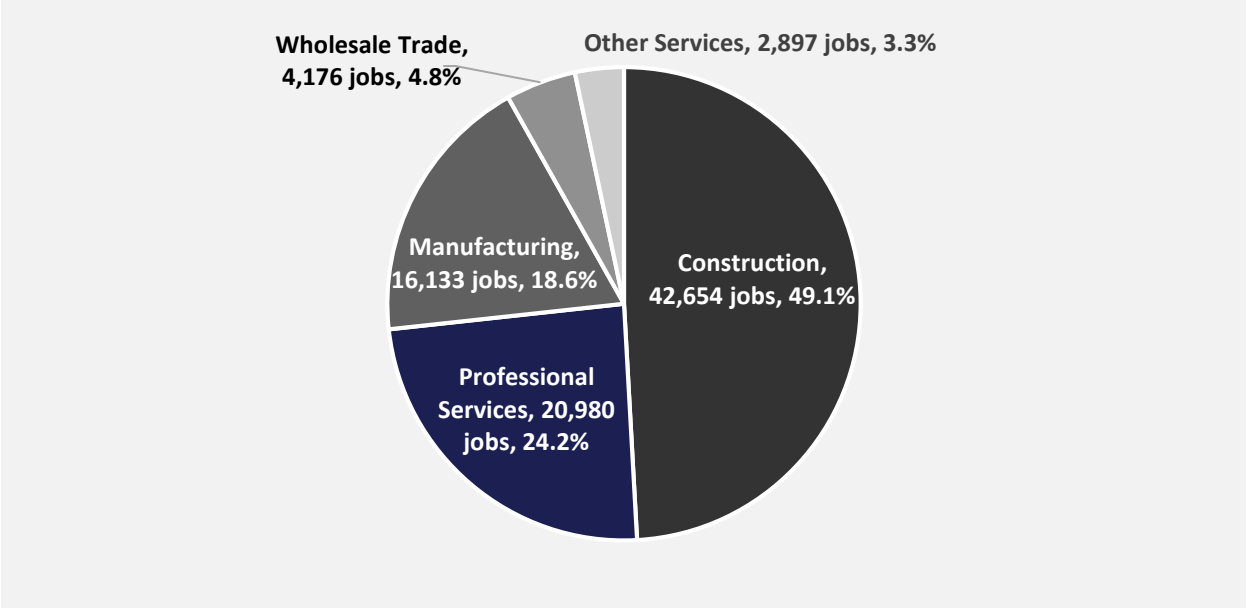


FIGURE 23. ALLIANCE STATE GRID MODERNIZATION AND STORAGE EMPLOYMENT BY VALUE CHAIN, 2019



CLEAN FUELS

With 69,941 jobs, clean fuels represented the smallest component of the Alliance states' clean energy workforce at the end of 2019—about three percent of all clean energy jobs in these states. The sector lost some jobs between 2016 and 2019, amounting to just over a one percent decline or 800 total jobs lost.

FIGURE 24. CLEAN FUELS PROPORTION OF CLEAN ENERGY JOBS, 2019

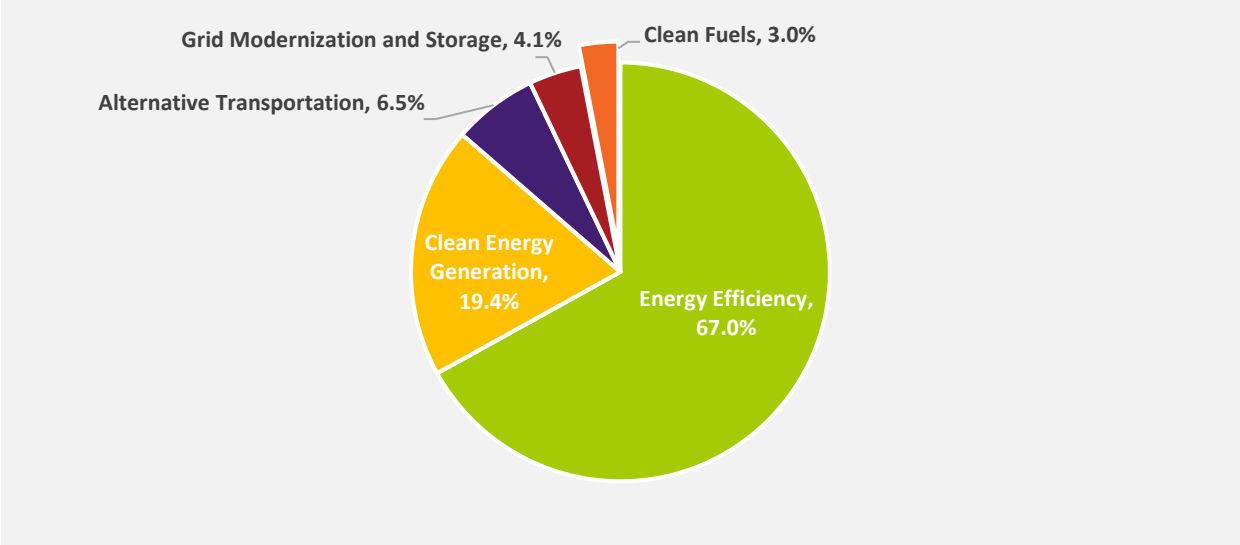
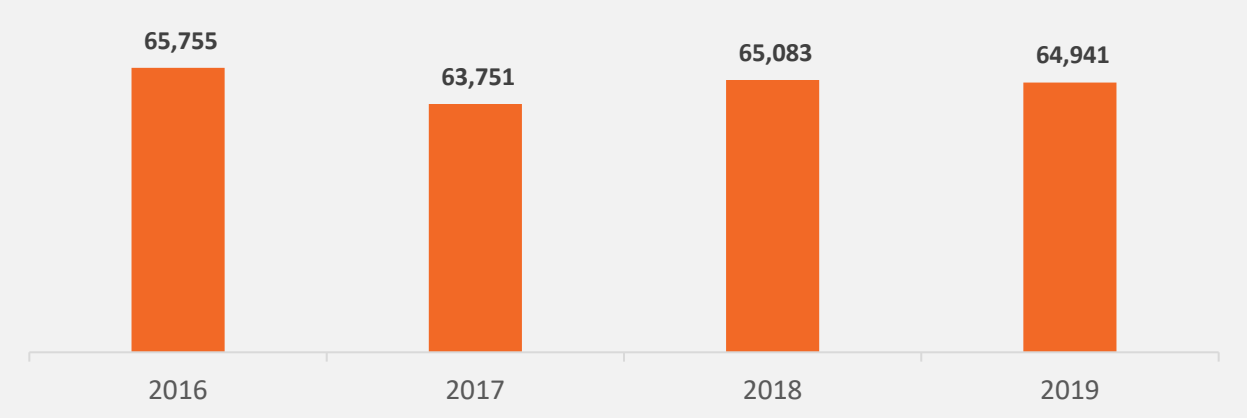


FIGURE 25. ALLIANCE STATE TOTAL CLEAN FUELS EMPLOYMENT, 2016-2019



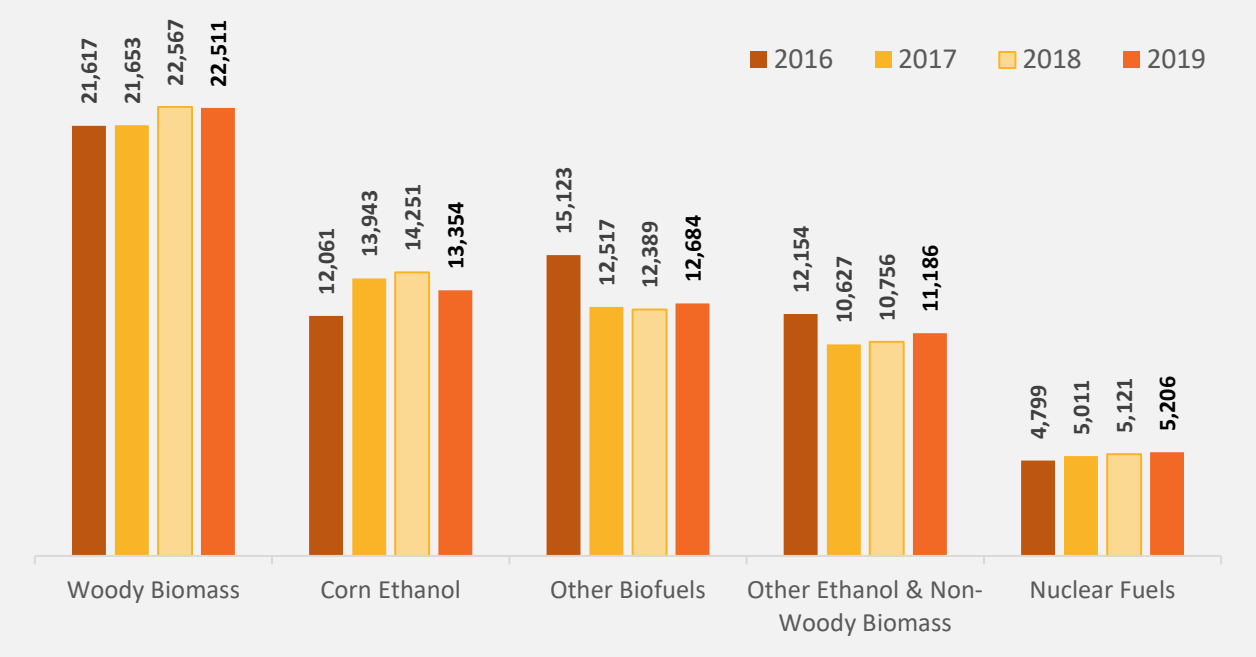
Of the top six states that accounted for more than 70 percent of national fuel ethanol production, two of them are Alliance states. As of 2018, Illinois was home to 13 ethanol plants and had the third-highest annual fuel ethanol nameplate capacity in the United States. Three-quarters of the state is farmland that provides the corn

feedstock for ethanol production. Minnesota also has 19 corn ethanol plants. Together, these two states produce 68 million barrels of fuel ethanol each year, accounting for just over a quarter of total fuel ethanol produced in the nation in 2018.[55]

Corn ethanol jobs were the second largest sub-sector within the clean fuels workforce in the Alliance states. These workers accounted for about 21 percent of total clean fuels jobs, or roughly 13,400 workers. Corn ethanol jobs in the Alliance states grew by almost 11 percent between 2016 and 2019. The largest clean fuels sub-sector in the Alliance states was woody biomass[56], which accounted for about a third of the clean fuels workforce at the end of 2019. From 2016 through 2019, woody biomass jobs grew by four percent or 894 workers.

The nuclear fuels sub-sector accounted for roughly 5,200 jobs in the Alliance states, with a growth rate of almost nine percent, or about 400 jobs, between 2016 and 2019. The remaining sub-sectors of other biofuels[57] and other ethanol or non-woody biomass[58] have shed jobs over the last three years, resulting in an overall job loss of about 3,400 workers.

FIGURE 26. ALLIANCE STATE CLEAN FUELS EMPLOYMENT BY SUB-TECHNOLOGY, 2016-2019



[55] U.S. Energy Information Administration. Six States Account for More than 70 percent of U.S. Fuel Ethanol Production. August 2018. Accessed April 2020.

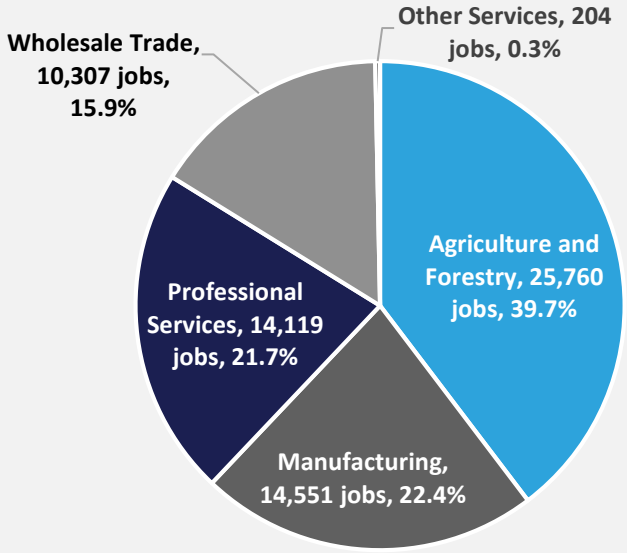
[56] Woody biomass fuels are developed from the by-product of management, restoration, and hazardous fuel reduction treatments, as well as the product of natural disasters, including trees and woody plants (limbs, tops, needles, leaves, and other woody parts, grown in a forest, woodland, or rangeland environment).

[57] Any other clean fuel that is derived directly from living matter.

[58] Includes fuels made from other materials such as straw, manure, vegetable oil, animal fats, etc.

Clean fuels strength lies in production and manufacturing, likely due to the aforementioned ethanol plants in Illinois and Minnesota. Pennsylvania too is home to clean fuels manufacturing capacities. The state has two biodiesel manufacturing plants that produce an annual 90 million gallons of biodiesel and five wood pellet manufacturing plants, which support a combined annual capacity of 354,000 tons.[59] With farmland and clean fuels manufacturing capacities, much of clean fuels employment in the Alliance states was concentrated in agriculture and forestry and manufacturing. The agriculture and forestry industry accounted for four in ten clean fuels workers in the Alliance states; these are individuals involved in crop production for corn ethanol, for example, or timber tract operations and other forestry activities that support woody biomass fuels, such as wood pellet and wood chip production. In total, agriculture and forestry workers that contribute to the clean fuels sector in the Alliance states accounted for almost 25,800 jobs. Clean fuels manufacturing workers represented just under a quarter (22 percent) of the workforce—roughly 14,600 jobs. Clean fuels manufacturing includes industries such as ethyl alcohol manufacturing or other basic organic chemical manufacturing.

FIGURE 27. ALLIANCE STATE CLEAN FUELS EMPLOYMENT BY VALUE CHAIN, 2019



[59] U.S. Energy Information Administration (EIA). Pennsylvania State Profile and Estimates. Last Updated August 2019. Accessed April 2020.

Hiring & Challenges

Prior to COVID-19, clean energy employers across Alliance and non-Alliance states alike reported that they were having difficulty finding qualified workers to fill clean energy positions at their firms (Figure 28). This varied by sector, but generally included technicians, sales representatives, management roles such as supervisors and directors, and engineers. The main reported reasons for hiring difficulty across all technology sectors included lack of experience, training, or technical skills; a small applicant pool; difficulty finding industry-specific knowledge, skills, and interest; inability to provide competitive wages; insufficient non-technical skills; and insufficient qualifications, such as certifications or educational attainment (Table 3).

Unfortunately, these sentiments were gathered before the global COVID-19 outbreak, and as such have likely changed significantly since the survey was originally fielded. Numerous job losses across the nation that have additionally impacted the clean energy industry (see the Clean Energy Employment Overview section for specific job losses) are likely altering the employment demands and realities for both clean energy employers and employees.

FIGURE 28. REPORTED HIRING DIFFICULTY BY TECHNOLOGY SECTOR, 2019

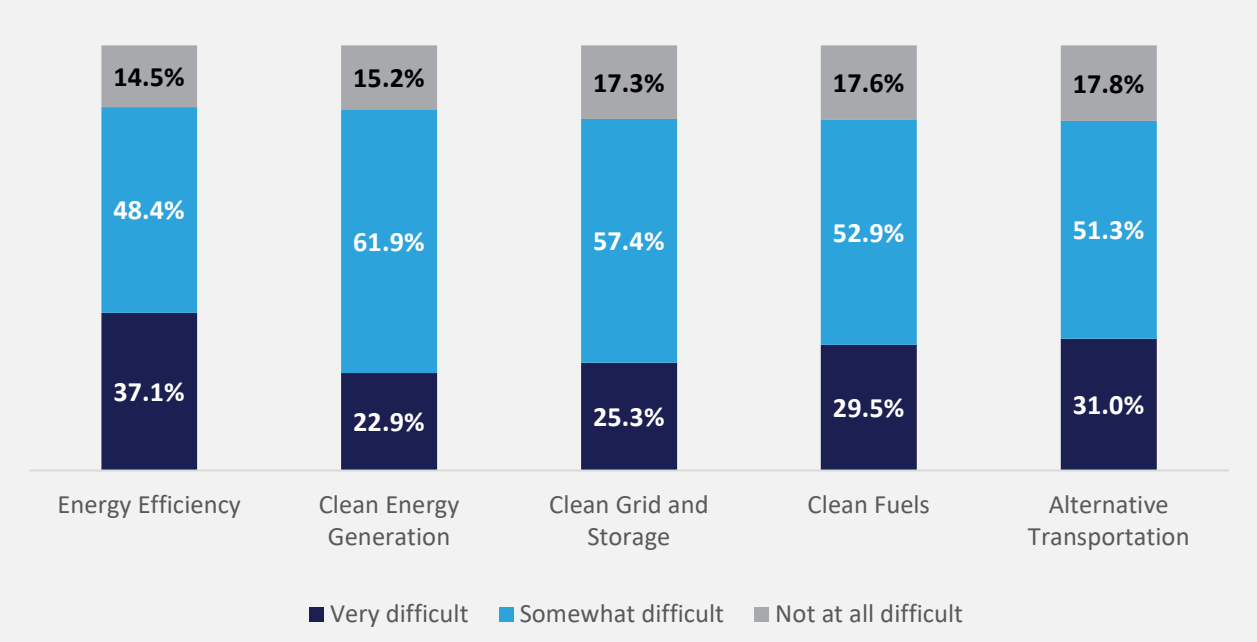


TABLE 3. REPORTED REASONS FOR HIRING DIFFICULTY BY TECHNOLOGY SECTOR, 2019[60]

	Energy Efficiency	Clean Energy Generation	Grid Modernization and Storage	Clean Fuels	Alternative Transportation
Insufficient non-technical skills[61]	17%	12%	10%	18%	63%
Lack of experience, training, or technical skills	54%	43%	38%	9%	38%
Competition/ small applicant pool	26%	36%	38%	18%	13%
Insufficient qualifications (certifications or education)	17%	14%	24%	36%	0%
Difficulty finding industry-specific knowledge, skills, and interest	21%	24%	33%	18%	13%
Cannot provide competitive wages	17%	10%	10%	18%	25%

Prior to COVID-19, clean energy firms across the Alliance states additionally reported that the inability to find qualified talent was stifling their business growth and profitability. Additional challenges were related to policy, the cost or supply of materials, permitting delays, and lack of capital. A common theme among employers that reported policy-related challenges cited policy volatility and uncertainty, particularly around federal tariffs.

[60] Percentages will not sum to 100 percent, as this was a multiple-choice question. The data in the table indicates what percentage of employers selected these as reasons for hiring difficulty. For example, 17 percent of surveyed energy efficiency employers indicated that their inability to provide competitive wages contributed to hiring difficulty between 2018 and 2019.
[61] Non-technical skills such as work ethic, dependability, or critical thinking.

TABLE 4. REPORTED CHALLENGES TO GROWTH AND PROFITABILITY BY TECHNOLOGY SECTOR, 2019[62]

	Energy Efficiency	Clean Energy Generation	Grid Modernization and Storage	Clean Fuels	Alternative Transportation
Lack of qualified talent	89%	88%	88%	75%	73%
Policy challenges	72%	89%	83%	73%	73%
Permitting delays	53%	80%	77%	40%	80%
Interconnection delays	40%	80%	76%	42%	20%
Cost or supply of materials	60%	72%	57%	75%	73%
Lack of capital	60%	61%	52%	50%	45%
Poor demand	45%	34%	45%	46%	45%

[62] This table illustrates the proportion of employers within each major technology sector that reported these challenges are either "very" or "somewhat" significant to their ability to grow a profitable clean energy business. Percentages will not sum to 100 percent, as this was a multiple-choice question. For example, 89 percent of surveyed energy efficiency employers reported that lack of qualified talent was a challenge to their business' growth and profitability.

Educational Attainment & Employment Benefits

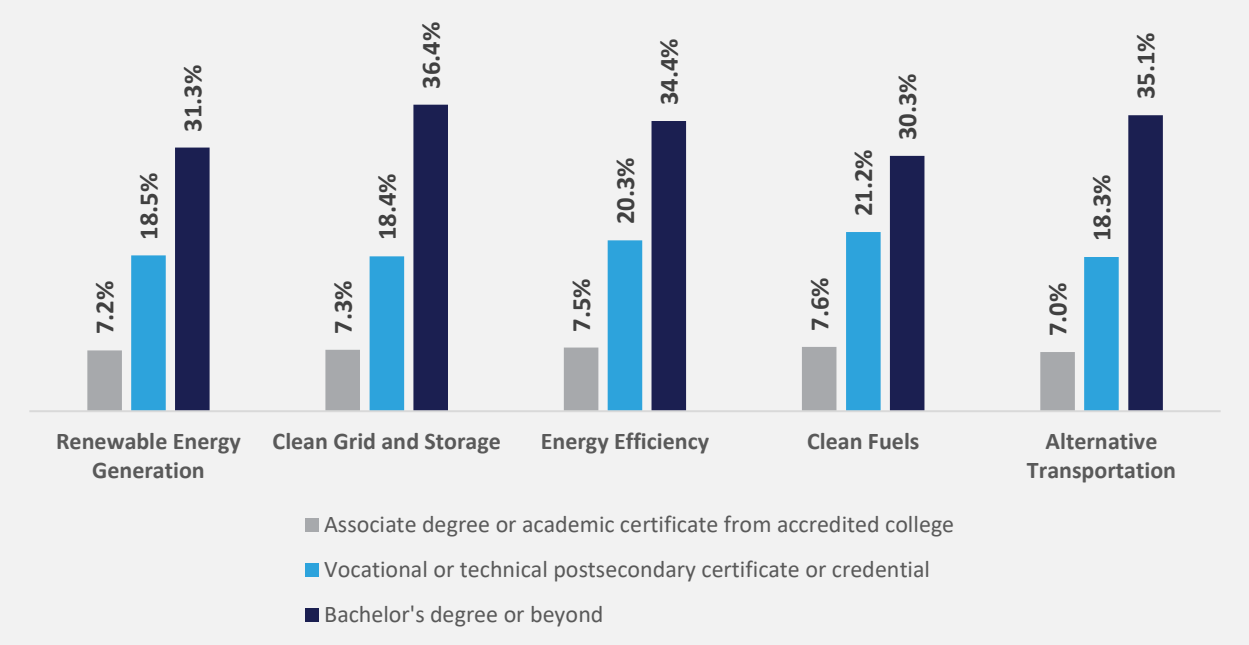
The following section provides a brief overview of clean energy jobs in the Alliance states, including average educational attainment of recent hires, wages, and employment benefits. For a more detailed examination of specific clean energy careers, please refer to Appendix C which identifies 10 clean energy occupations and their typical career progressions, wage levels, common certifications, healthcare and retirement benefits, and knowledge, skills, and abilities.

EDUCATIONAL ATTAINMENT

Across the board, new clean energy openings that had been filled in the 12 months between the end of 2018 and the end of 2019 ranged in educational attainment. For each technology sector, between 18 and 21 percent of new hires were required to have at most a vocational or technical postsecondary credential, while 30 to 36 percent were required to have a Bachelor's degree or higher. Roughly seven to eight percent of new hires were required to have no more than an Associate's degree or certificate from an accredited college.

Please note that this data refers solely to clean energy workers that were hired over the 12 months between Q4 2018 and Q4 2019 across the Alliance states. This does not represent the educational requirements for the overall clean energy workforce.

FIGURE 29. REQUIRED EDUCATION LEVEL OF NEW HIRES OVER LAST 12 MONTHS



This type of variability in educational attainment—where requirements fall at both ends of the spectrum—is typical of clean energy careers and is largely due to the fact that clean energy sectors house occupations ranging from technicians, electricians, or maintenance workers, to engineers, executives, and analysts. These are occupations with vastly different education levels and aggregated data by technology sector can often mask these occupational differences. For example, a study by The Brookings Institution found that because educational attainment by occupation varies so significantly, aggregate statistics can be misleading. An energy efficiency electrician is much more likely to have a high school diploma or less compared to electrical or environmental engineers, which tend to have at least a Bachelor's degree. Overall, however, the study found that clean energy workers tend to have less formal education compared to the national average.[63]

WAGES AND EMPLOYMENT BENEFITS

Despite lower-than-average educational attainment, many clean energy workers still earned above-average wages.[64] Across the Alliance states, nine in ten (92 percent) clean energy-specific jobs surveyed in this research effort[65] earned more than the corresponding national median wage for each occupation. This means that an electrician installing energy efficient lighting or a wholesale trade sales representative selling electric vehicle component parts earned more per hour compared to the average electrician or sales representative in the United States. In fact, this was true across all levels of experience—clean energy workers from entry- to senior-level positions were earning more than their corresponding occupational medians. Wage data from the United States Energy and Employment Report (USEER) for the Alliance states found that of surveyed clean energy occupations, nearly all entry-level clean energy jobs (98 percent) paid a premium, and respectively, 97 percent and 82 percent of all surveyed mid- and senior-level clean energy positions also paid a premium above the corresponding national medians.[66] For a full list of all clean energy occupational wages by sector, occupation, and experience level, please refer to Appendix B of this report.

The majority of clean energy workers in the Alliance states received healthcare and retirement benefits from their employers. Nine in ten (92 percent) clean energy employers in the Alliance states reported providing some form of healthcare insurance coverage—either their business covers all health insurance costs or at least some of their health insurance costs. This compared to the national private sector average of 69 percent.[67]

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[63] The Brookings Institution, Metropolitan Policy Program. Advancing Inclusion Through Clean Energy Jobs. April 2019. This Brookings study relied partially on data from the USEER report to develop its methodology and definition of clean energy jobs. Because the USEER methodology and data underpin this USCA report, findings from the Brookings report may be used as a comparable proxy for clean energy jobs in the Alliance states and nation overall.

[64] *Id.* The Brookings study found that clean energy workers earn higher wages compared to all workers nationally—roughly eight to 19 percent above national averages. Workers at lower ends of the income spectrum also earn $5 to $10 more per hour than other jobs.

[65] This proportion is only out of surveyed occupations. Out of all 765 five-digit Standard Occupational Classification (SOC) codes from the Bureau of Labor Statistics, the dataset includes data on 78 occupations or SOCs—about 10 percent of all SOC codes.

[66] While these percentages may seem high, it is important to note that in general, most jobs across the Alliance states tend to provide a premium over the national average.

[67] Bureau of Labor Statistics. Employee Benefits in the United States, March 2019. https://www.bls.gov/news.release/pdf/ebs2.pdf.

The majority of clean energy workers in the Alliance states also received retirement contributions from their employers. Eighty-four percent of clean energy employers in the Alliance states reported some form of retirement contribution for their workers; this is significantly higher than the national private sector average of 67 percent.[68]

In a separate study that examined only energy efficiency jobs across the state of Massachusetts, clean energy workers reported other additional employment benefits, such as high levels of career satisfaction, flexible work schedules, company vehicles, tuition support, and transportation stipends.[69]

FIGURE 30. HEALTH INSURANCE BENEFITS FOR ALLIANCE STATE CLEAN ENERGY JOBS, 2019

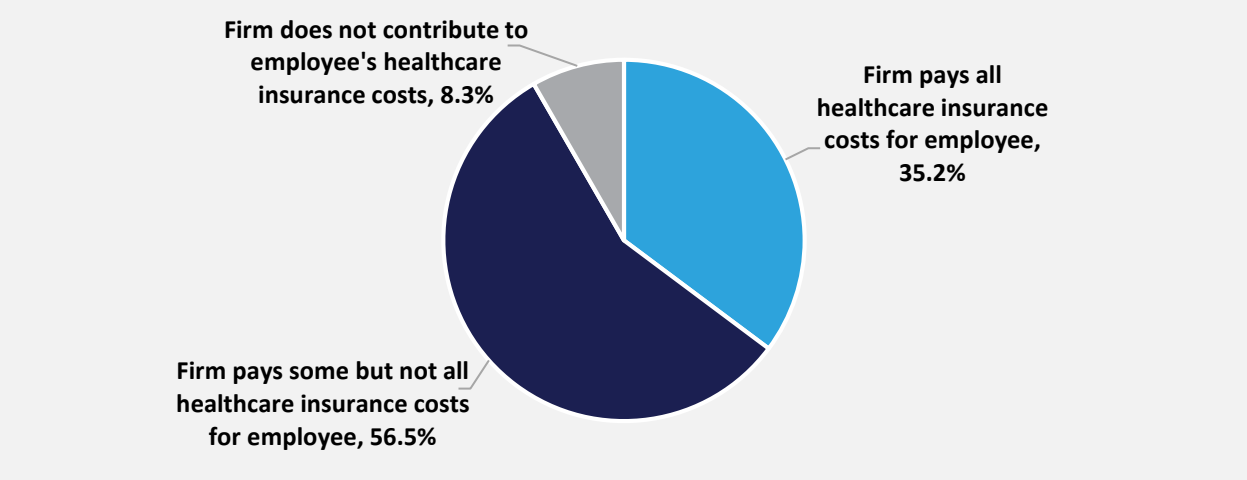
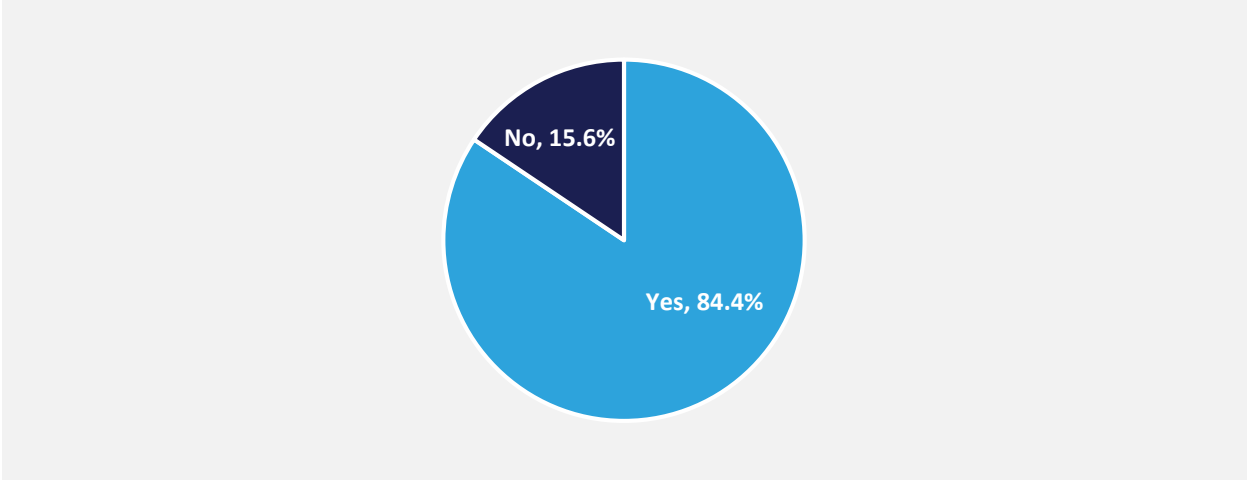


FIGURE 31. RETIREMENT CONTRIBUTIONS FOR ALLIANCE STATE CLEAN ENERGY JOBS, 2019



[68] *Id.*

[69] Massachusetts Program Administrators. Massachusetts Energy Efficiency Workforce Development Needs Assessment. March 2020. http://ma-eeac.org/wordpress/wp-content/uploads/Massachusetts-Energy-Efficiency-Workforce-Development-FINAL-REPORT-CAREER-PROFILES.pdf

Clean Energy Demographics

Overall, the clean energy industry lacked ethnic, racial, and gender diversity at the end of 2019. Nationally, Hispanic or Latinx individuals comprised almost 18 percent of the U.S. labor force, but for all technology sectors in the Alliance states except clean energy generation, Hispanic or Latinx representation was about one to seven points lower than this national average. Similarly, the national average for Black or African American workers in the U.S. labor force was 12 percent in 2019, four points higher than the proportion of Black or African American workers in the Alliance states' clean energy industry.

There was also low representation for women across all technology sectors. Nationally, women represented 47 percent of the American workforce. As a proportion of the clean energy workforce in Alliance states, women represented approximately one quarter of clean energy jobs. However, Alliance states did tend to have more private-sector Union members compared to non-Alliance states.

TABLE 5. ALLIANCE STATE CLEAN ENERGY DEMOGRAPHICS, 2019

	Alliance States	Non-Alliance States	Overall National Workforce Average[70]
Male	74.7%	74.6%	53.0%
Female	25.3%	25.4%	47.0%
Hispanic or Latinx	16.3%	15.4%	17.6%
Not Hispanic or Latinx	83.7%	84.6%	82.4%
American Indian or Alaska Native	1.4%	1.3%	1.3%
Asian	6.9%	5.7%	6.5%
Black or African American	8.0%	8.3%	12.3%
Native Hawaiian or Pacific Islander	1.1%	1.1%	0.2%
White	74.9%	77.2%	77.7%
Two or more races	7.6%	6.6%	2.8%
Veterans	8.5%	9.3%	5.7%
55 and over	12.6%	15.0%	23.6%
Union	10.1%	7.9%	6.2%

[70] Demographics for the overall nationwide workforce are from the Bureau of Labor Statistics, Labor Force Statistics from the Current Population Survey, 2019, and Emsi Population Demographics of the United States, 2019. Union membership is from the Bureau of Labor Statistics, 2019 Union Members News Release, 22 January 2020. The union membership rate is exclusive to private-sector workers. https://www.bls.gov/news.release/pdf/union2.pdf.

Appendix A: Clean Energy Wages

The following tables provide hourly earnings for clean energy occupations in the Alliance states by major technology sector, and for three levels of experience—entry-, mid-, and senior-level.[71]

Energy Efficiency

Standard Occupational Classification (SOC) Code	Description	Entry-level	Mid-level	Senior-level
11-1011	Chief Executives	$52.17	$96.91	$159.31
11-1021	General and Operations Managers	$30.11	$52.77	$106.75
11-9021	Construction Managers	$37.47	$49.51	$72.17
13-1199	Business Operations Specialists, All Other	$21.17	$34.36	$55.45
13-2011	Accountants and Auditors	$26.72	$35.64	$53.31
15-1122	Information Security Analysts	$32.97	$48.65	$71.17
15-1199	Computer Occupations, All Other	$26.61	$43.26	$68.18
17-2199	Engineers, All Other	$29.03	$48.53	$71.33
19-2041	Environmental Scientists and Specialists, Including Health	$23.44	$33.55	$51.12
19-2042	Geoscientists, Except Hydrologists and Geographers	$25.20	$37.38	$61.59
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	$23.90	$39.90	$68.72
43-3031	Bookkeeping, Accounting, and Auditing Clerks	$15.61	$23.63	$32.58
43-5061	Production, Planning, and Expediting Clerks	$16.38	$26.08	$38.54
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	$14.24	$19.80	$27.61
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	$23.77	$34.52	$51.56
47-2011	Boilermakers	$23.61	$37.06	$49.18
47-2021	Brickmasons and Blockmasons	$20.27	$29.52	$45.05
47-2031	Carpenters	$18.08	$27.45	$43.21
47-2061	Construction Laborers	$14.99	$21.23	$36.12
47-2073	Operating Engineers and Other Construction Equipment Operators	$20.43	$29.66	$45.55
47-2081	Drywall and Ceiling Tile Installers	$17.70	$25.93	$42.91
47-2111	Electricians	$20.25	$32.13	$50.57

[71] National wage comparatives are from the Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Q4 2019. Entry-level wages are at the 20th percentile, mid-level are median hourly wages, and senior-level wages are at the 90th percentile.

47-2131	Insulation Workers, Floor, Ceiling, and Wall	$15.47	$21.32	$35.81
47-2132	Insulation Workers, Mechanical	$19.05	$28.01	$45.95
47-2151	Pipelayers	$17.04	$24.71	$36.14
47-2152	Plumbers, Pipefitters, and Steamfitters	$19.60	$31.01	$50.20
47-2181	Roofers	$17.41	$25.29	$37.55
47-2211	Sheet Metal Workers	$17.54	$28.83	$45.12
47-2221	Structural Iron and Steel Workers	$21.00	$34.53	$47.81
47-3012	Helpers--Carpenters	$11.93	$17.00	$23.20
47-3013	Helpers--Electricians	$12.76	$17.37	$24.68
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	$12.74	$16.67	$23.01
47-4031	Fence Erectors	$11.81	$14.38	$18.83
47-4098	Miscellaneous Construction and Related Workers	$12.56	$16.73	$24.98
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	$22.12	$35.33	$51.10
49-9012	Control and Valve Installers and Repairers, Except Mechanical Door	$23.63	$38.50	$50.64
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	$20.42	$29.84	$43.02
49-9041	Industrial Machinery Mechanics	$22.44	$30.85	$41.34
49-9051	Electrical Power-Line Installers and Repairers	$29.25	$46.23	$57.63
49-9071	Maintenance and Repair Workers, General	$16.33	$23.51	$34.00
49-9098	Helpers--Installation, Maintenance, and Repair Workers	$13.87	$17.81	$25.40
49-9099	Installation, Maintenance, and Repair Workers, All Other	$16.68	$23.63	$35.32
51-1011	First-Line Supervisors of Production and Operating Workers	$21.33	$32.29	$47.45
51-2098	Assemblers and Fabricators, All Other, Including Team Assemblers	$13.06	$16.75	$24.65
51-4121	Welders, Cutters, Solderers, and Brazers	$17.83	$23.44	$33.12
51-4199	Metal Workers and Plastic Workers, All Other	$14.09	$18.42	$29.44
51-9199	Production Workers, All Other	$11.38	$15.06	$24.53
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	$13.83	$17.36	$24.98
53-7199	Material Moving Workers, All Other	$15.10	$18.32	$28.93

Clean Energy Generation

Standard Occupational Classification (SOC) Code	Description	Entry-level	Mid-level	Senior-level
11-1011	Chief Executives	$54.95	$100.24	$162.10
11-1021	General and Operations Managers	$31.71	$54.58	$108.61
11-9021	Construction Managers	$40.52	$52.14	$74.18
13-1199	Business Operations Specialists, All Other	$22.20	$34.36	$56.70
13-2011	Accountants and Auditors	$27.48	$36.48	$53.74
15-1122	Information Security Analysts	$35.76	$52.96	$76.01
15-1199	Computer Occupations, All Other	$28.86	$47.09	$72.81
17-2199	Engineers, All Other	$33.00	$59.10	$93.43
17-3019	Drafters, All Other	$18.78	$26.39	$38.49
17-3029	Engineering Technicians, Except Drafters, All Other	$20.54	$29.98	$43.50
17-3031	Surveying and Mapping Technicians	$16.70	$24.26	$37.08
19-2041	Environmental Scientists and Specialists, Including Health	$22.67	$33.47	$53.01
19-2042	Geoscientists, Except Hydrologists and Geographers	$24.37	$37.29	$63.86
19-4041	Geological and Petroleum Technicians	$20.37	$29.41	$52.94
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	$26.67	$42.52	$72.59
43-3031	Bookkeeping, Accounting, and Auditing Clerks	$15.87	$24.78	$32.96
43-5041	Meter Readers, Utilities	$16.03	$26.39	$39.55
43-5061	Production, Planning, and Expediting Clerks	$15.99	$24.24	$36.54
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	$14.24	$20.27	$28.32
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	$25.89	$36.63	$57.00
47-2011	Boilermakers	$23.38	$37.54	$48.37
47-2061	Construction Laborers	$14.84	$21.50	$35.52
47-2073	Operating Engineers and Other Construction Equipment Operators	$20.24	$30.05	$44.79
47-2111	Electricians	$20.05	$32.55	$49.74
47-2132	Insulation Workers, Mechanical	$18.87	$28.37	$45.19
47-2151	Pipelayers	$16.88	$25.03	$35.54
47-2152	Plumbers, Pipefitters, and Steamfitters	$19.41	$31.41	$49.37
47-2181	Roofers	$17.25	$25.61	$36.93
47-2211	Sheet Metal Workers	$17.37	$29.20	$44.37
47-2221	Structural Iron and Steel Workers	$20.80	$34.97	$47.02
47-2231	Solar Photovoltaic Installers	$15.40	$21.83	$31.41
47-3013	Helpers--Electricians	$12.76	$17.29	$24.31

47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	$12.74	$16.60	$22.66
47-4098	Miscellaneous Construction and Related Workers	$12.73	$16.61	$25.32
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	$23.68	$35.39	$52.51
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	$58.17	$66.71	$71.71
49-9012	Control and Valve Installers and Repairers, Except Mechanical Door	$23.95	$39.35	$50.33
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	$20.69	$30.50	$42.76
49-9041	Industrial Machinery Mechanics	$22.74	$31.53	$41.09
49-9051	Electrical Power-Line Installers and Repairers	$29.64	$47.25	$57.28
49-9071	Maintenance and Repair Workers, General	$16.55	$24.03	$33.80
49-9081	Wind Turbine Service Technicians	$19.50	$27.28	$40.69
49-9098	Helpers--Installation, Maintenance, and Repair Workers	$14.05	$18.21	$25.25
49-9099	Installation, Maintenance, and Repair Workers, All Other	$16.90	$24.15	$35.10
51-1011	First-Line Supervisors of Production and Operating Workers	$21.33	$30.62	$45.70
51-2098	Assemblers and Fabricators, All Other, Including Team Assemblers	$12.53	$16.75	$24.65
51-4121	Welders, Cutters, Solderers, and Brazers	$16.61	$21.91	$30.44
51-4199	Metal Workers and Plastic Workers, All Other	$13.12	$17.22	$27.06
51-8012	Power Distributors and Dispatchers	$46.14	$53.90	$64.33
51-8013	Power Plant Operators	$35.97	$49.46	$58.73
51-8099	Plant and System Operators, All Other	$29.27	$35.86	$45.02
51-9199	Production Workers, All Other	$12.17	$15.69	$25.02
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	$15.29	$20.56	$32.12
53-7199	Material Moving Workers, All Other	$16.69	$21.69	$37.20

Alternative Transportation

Standard Occupational Classification (SOC) Code	Description	Entry-level	Mid-level	Senior-level
11-1011	Chief Executives	$56.43	$100.71	$163.21
11-1021	General and Operations Managers	$32.57	$54.84	$109.36
13-1199	Business Operations Specialists, All Other	$21.53	$33.65	$57.21
13-2011	Accountants and Auditors	$26.72	$35.09	$53.02
15-1122	Information Security Analysts	$34.65	$50.80	$72.69
15-1199	Computer Occupations, All Other	$27.97	$45.17	$69.63
17-2199	Engineers, All Other	$32.74	$61.25	$93.11
17-3019	Drafters, All Other	$18.92	$27.16	$40.53
17-3029	Engineering Technicians, Except Drafters, All Other	$20.70	$30.86	$45.80
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	$25.26	$40.84	$68.96
43-3031	Bookkeeping, Accounting, and Auditing Clerks	$15.87	$24.21	$32.96
43-5061	Production, Planning, and Expediting Clerks	$18.08	$29.33	$39.50
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	$14.24	$20.20	$28.32
47-2061	Construction Laborers	$17.03	$24.94	$41.74
47-2073	Operating Engineers and Other Construction Equipment Operators	$23.21	$34.85	$52.63
47-2111	Electricians	$23.00	$37.76	$58.44
47-2132	Insulation Workers, Mechanical	$21.64	$32.91	$53.09
47-2152	Plumbers, Pipefitters, and Steamfitters	$22.27	$36.43	$58.01
47-2211	Sheet Metal Workers	$19.93	$33.87	$52.14
47-2221	Structural Iron and Steel Workers	$23.85	$40.57	$55.25
47-3013	Helpers--Electricians	$14.03	$17.50	$25.66
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	$14.01	$16.79	$23.92
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	$22.74	$33.92	$50.00
49-3021	Automotive Body and Related Repairers	$13.62	$22.03	$36.22
49-3023	Automotive Service Technicians and Mechanics	$12.50	$21.09	$34.19
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	$16.11	$24.74	$36.80
49-3042	Mobile Heavy Equipment Mechanics, Except Engines	$22.96	$29.35	$38.40
49-9012	Control and Valve Installers and Repairers, Except Mechanical Door	$21.39	$33.55	$43.88
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	$18.48	$26.00	$37.28
49-9041	Industrial Machinery Mechanics	$20.31	$26.88	$35.82
49-9071	Maintenance and Repair Workers, General	$14.78	$20.49	$29.47
49-9098	Helpers--Installation, Maintenance, and Repair Workers	$12.55	$15.52	$22.01
49-9099	Installation, Maintenance, and Repair Workers, All Other	$15.10	$20.59	$30.60

51-1011	First-Line Supervisors of Production and Operating Workers	$19.82	$29.80	$45.03
51-2098	Assemblers and Fabricators, All Other, Including Team Assemblers	$12.16	$16.29	$24.65
51-4121	Welders, Cutters, Solderers, and Brazers	$17.39	$22.72	$32.31
51-4199	Metal Workers and Plastic Workers, All Other	$13.74	$17.85	$28.72
51-9199	Production Workers, All Other	$11.99	$15.27	$25.91
53-3031	Driver/Sales Workers	$13.50	$15.66	$27.06
53-3032	Heavy and Tractor-Trailer Truck Drivers	$22.39	$26.69	$35.77
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	$11.92	$15.66	$24.53
53-7199	Material Moving Workers, All Other	$13.02	$16.52	$28.41

Grid Modernization and Storage

Standard Occupational Classification (SOC) Code	Description	Entry-level	Mid-level	Senior-level
11-1011	Chief Executives	$52.97	$97.86	$164.58
11-1021	General and Operations Managers	$30.57	$53.29	$110.27
11-9021	Construction Managers	$36.86	$50.68	$75.62
13-2011	Accountants and Auditors	$26.72	$35.37	$52.81
15-1122	Information Security Analysts	$35.19	$51.82	$74.78
15-1199	Computer Occupations, All Other	$28.40	$46.08	$71.64
17-2199	Engineers, All Other	$26.67	$46.16	$76.07
19-2041	Environmental Scientists and Specialists, Including Health	$23.44	$32.13	$51.12
19-2042	Geoscientists, Except Hydrologists and Geographers	$25.20	$35.79	$61.59
19-4041	Geological and Petroleum Technicians	$17.30	$26.00	$49.72
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	$25.26	$40.68	$70.06
43-3031	Bookkeeping, Accounting, and Auditing Clerks	$15.87	$24.21	$33.50
43-5041	Meter Readers, Utilities	$16.47	$27.29	$41.90
43-5061	Production, Planning, and Expediting Clerks	$16.42	$25.07	$38.72
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	$14.24	$20.00	$28.19
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	$21.96	$31.41	$48.55
47-2011	Boilermakers	$24.01	$37.35	$50.64
47-2061	Construction Laborers	$15.24	$21.39	$37.19
47-2073	Operating Engineers and Other Construction Equipment Operators	$20.78	$29.90	$46.89
47-2111	Electricians	$20.59	$32.38	$52.07
47-2132	Insulation Workers, Mechanical	$19.37	$28.23	$47.30
47-2151	Pipelayers	$17.33	$24.91	$37.21
47-2152	Plumbers, Pipefitters, and Steamfitters	$19.93	$31.25	$51.69
47-2181	Roofers	$17.71	$25.49	$38.66
47-2211	Sheet Metal Workers	$17.83	$29.05	$46.46
47-2221	Structural Iron and Steel Workers	$21.35	$34.80	$49.22
47-3013	Helpers--Electricians	$13.29	$18.43	$26.91
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	$13.27	$17.70	$25.09
47-4031	Fence Erectors	$13.04	$14.59	$20.00
47-4098	Miscellaneous Construction and Related Workers	$13.88	$16.98	$26.53
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	$23.68	$34.62	$52.39
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	$61.18	$69.44	$72.83

49-3042	Mobile Heavy Equipment Mechanics, Except Engines	$25.52	$31.31	$40.12
49-9012	Control and Valve Installers and Repairers, Except Mechanical Door	$24.56	$41.14	$51.59
49-9041	Industrial Machinery Mechanics	$23.32	$32.96	$42.11
49-9051	Electrical Power-Line Installers and Repairers	$30.40	$49.40	$58.71
49-9071	Maintenance and Repair Workers, General	$16.97	$25.12	$34.64
49-9098	Helpers--Installation, Maintenance, and Repair Workers	$14.41	$19.03	$25.88
49-9099	Installation, Maintenance, and Repair Workers, All Other	$17.33	$25.25	$35.98
51-1011	First-Line Supervisors of Production and Operating Workers	$19.82	$30.05	$45.03
51-2098	Assemblers and Fabricators, All Other, Including Team Assemblers	$12.63	$16.23	$23.91
51-4121	Welders, Cutters, Solderers, and Brazers	$17.63	$23.44	$34.15
51-4199	Metal Workers and Plastic Workers, All Other	$13.93	$18.42	$30.36
51-8012	Power Distributors and Dispatchers	$44.99	$54.65	$63.26
51-8013	Power Plant Operators	$35.07	$50.14	$57.75
51-8099	Plant and System Operators, All Other	$28.54	$36.36	$44.27
51-9199	Production Workers, All Other	$12.45	$14.52	$25.68
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	$14.58	$20.34	$29.86
53-7199	Material Moving Workers, All Other	$15.91	$21.46	$34.58

Clean Fuels

Standard Occupational Classification (SOC) Code	Description	Entry-level	Mid-level	Senior-level
11-1011	Chief Executives	$52.22	$97.48	$162.61
11-1021	General and Operations Managers	$30.14	$53.08	$108.96
11-9021	Construction Managers	$39.30	$52.31	$73.23
13-1199	Business Operations Specialists, All Other	$21.17	$34.36	$55.95
13-2011	Accountants and Auditors	$26.72	$36.03	$52.50
15-1122	Information Security Analysts	$33.97	$49.54	$71.30
15-1199	Computer Occupations, All Other	$27.42	$44.05	$68.31
17-2199	Engineers, All Other	$32.60	$60.07	$94.41
17-3019	Drafters, All Other	$18.83	$26.07	$38.49
17-3029	Engineering Technicians, Except Drafters, All Other	$20.59	$29.62	$43.50
17-3031	Surveying and Mapping Technicians	$16.74	$23.97	$37.08
19-2041	Environmental Scientists and Specialists, Including Health	$25.35	$34.98	$53.76
19-2042	Geoscientists, Except Hydrologists and Geographers	$27.25	$38.97	$64.77
19-4041	Geological and Petroleum Technicians	$19.59	$28.88	$50.18
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	$26.32	$42.19	$73.18
43-3031	Bookkeeping, Accounting, and Auditing Clerks	$15.67	$23.63	$32.41
43-5061	Production, Planning, and Expediting Clerks	$16.04	$25.53	$37.33
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	$14.24	$20.00	$27.43
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	$24.56	$34.79	$51.97
47-2061	Construction Laborers	$15.04	$20.68	$36.06
47-2073	Operating Engineers and Other Construction Equipment Operators	$20.51	$28.90	$45.46
47-2111	Electricians	$20.32	$31.31	$50.48
47-2151	Pipelayers	$17.11	$24.08	$36.07
47-2152	Plumbers, Pipefitters, and Steamfitters	$19.67	$30.21	$50.11
47-2181	Roofers	$17.48	$24.64	$37.48
47-2211	Sheet Metal Workers	$17.60	$28.08	$45.04
47-2221	Structural Iron and Steel Workers	$21.07	$33.64	$47.72
47-3013	Helpers--Electricians	$12.32	$17.64	$24.90
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	$12.30	$16.93	$23.22
47-5081	Helpers--Extraction Workers	$15.17	$19.27	$24.33
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	$24.82	$35.59	$51.50
49-9012	Control and Valve Installers and Repairers, Except Mechanical Door	$24.59	$40.09	$50.91

49-9041	Industrial Machinery Mechanics	$23.35	$32.12	$41.56
49-9071	Maintenance and Repair Workers, General	$16.99	$24.48	$34.19
49-9098	Helpers--Installation, Maintenance, and Repair Workers	$14.43	$18.55	$25.54
49-9099	Installation, Maintenance, and Repair Workers, All Other	$17.36	$24.60	$35.51
51-1011	First-Line Supervisors of Production and Operating Workers	$21.08	$31.10	$47.25
51-2098	Assemblers and Fabricators, All Other, Including Team Assemblers	$13.02	$16.99	$25.12
51-4121	Welders, Cutters, Solderers, and Brazers	$17.75	$22.99	$32.20
51-4199	Metal Workers and Plastic Workers, All Other	$14.02	$18.07	$28.63
51-9199	Production Workers, All Other	$12.45	$15.61	$26.89
53-3031	Driver/Sales Workers	$13.77	$15.92	$26.03
53-3032	Heavy and Tractor-Trailer Truck Drivers	$22.84	$27.14	$34.42
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	$15.56	$21.13	$30.84
53-7199	Material Moving Workers, All Other	$16.99	$22.29	$35.71

Appendix B: Clean Energy Career Profiles

The following career profiles present additional detail on 10 occupations that are commonly found working in clean energy technology sectors. These include:

1. General and Operations Managers
2. Bookkeeping, Accounting, and Auditing Clerks
3. Engineers
4. Electricians
5. Solar Photovoltaic Installers
6. Construction and Maintenance Trades Workers
7. Sales Representatives (Wholesale and Manufacturing, Technical and Scientific Products)
8. Drafters, Engineering Technicians, and Mapping Technicians
9. Heating, Air Conditioning, and Refrigeration Mechanics and Installers
10. Electrical Power-Line Installers and Repairers

Data and information for these profiles was pulled from a variety of sources, including public data from the Bureau of Labor Statistics and the Department of Labor, as well as the 2020 United States Energy and Employment Report (USEER). The occupations were assigned to the nearest corresponding Standard Occupational Classification Code (SOC).

Job descriptions, skills, and knowledge are compiled from O*NET OnLine, a resource managed by the US Department of Labor. Wages are based on the Bureau of Labor Statistics' Occupational Employment Statistics (OES) and a wage survey connected with the United States Energy and Employment Report (USEER). Feeder and promotion occupations as well as healthcare and retirement benefits are also tied to responses from the USEER wage survey. The estimated wages are reflective of national wages in Quarter 3 of 2019 across all clean energy technology sectors. For example, the entry-level wage of $30.60 for General and Operations Managers is an average of these jobs across clean energy generation, energy efficiency, alternative transportation, grid modernization and storage, and clean fuels. Common certifications are based on employer responses from the survey and a literature review; these are not meant to be exhaustive or comprehensive, but rather an overview of common certifications.

Appendix C: Research Methodology

EMPLOYMENT, HIRING, & DEMOGRAPHIC DATA

Data for the 2020 U.S. Climate Alliance Clean Energy Jobs Report is based on the United States Energy and Employment (USEER). The research methodology for USEER may be found at:

https://www.usenergyjobs.org/

An executive summary and appendices, which include the methodology, can also be found directly at the following links:

https://www.usenergyjobs.org/2020-report

Download USEER Appendix A

Download USEER Appendix B

FULL-TIME EQUIVALENT JOBS

FTE jobs are extrapolated using state employment thresholds weighted on census division and previous year's data. These thresholds are adjusted for response bias between our known and unknown universes, then the proportion of firm revenues from energy projects are incorporated. Employment thresholds are survey data from questions asking what percent of a firm's employment spends at least 50 percent of their time working on clean energy-related activities and what percent spends all their time. Using the weighted and adjusted thresholds, employment by state is then split into three groups, those that spend all (100 percent) of their time on clean energy-related activities, those that spend a majority (50 to 99 percent) of their time, and those that spend less than a majority (0 to 49 percent) of their time. These employment groups are weighted 0.25 on the less than a majority group, 0.75 on the majority group, and 1 on the 100 percent group. FTE jobs are the sum of these products.

WAGE DATA

Reported technology wages at the detailed occupational level (as determined by the Standard Occupational Classifications, or SOCs) are a product of detailed occupational (5-digit SOC) wages provided by the Bureau of Labor Statistics, a technology-specific multiplier created at the broad (2-digit) occupational level, and a geographic-specific multiplier created at the broad occupational level.

As stated above, technology-specific detailed occupation wages are a product of BLS-provided detailed occupation wages and a technology-specific broad occupation multiplier. These technology-specific broad occupation multipliers are the quotients of adjusted broad occupation wages over BLS-provided broad occupation wages. The adjusted broad occupation wages are four-fifths BLS-provided broad occupation wages and one-fifth survey-produced broad occupation wages from USCA-abiding firms. The survey-produced broad occupation wages are

averages of survey-produced detailed occupation salaries divided by 2080 (a year's working hours assuming full-time employment).

The geographic-specific multiplier is the quotient of the BLS broad occupation wages among the USCA participating states over the national BLS provided broad occupation wages. This allows the research team to capture the premium or discount the USCA-defined region has over the rest of the nation.

Appendix D: Clean Energy Technology List

An clean energy job is defined as any worker that is directly involved with the research, development, production, manufacture, distribution, sales, implementation, installation, or repair of components, goods, or services related to the following sectors of Clean energy generation; Grid Modernization and Storage; Energy Efficiency; Clean Fuels; and Alternative Transportation. These jobs also include supporting services such as consulting, finance, tax, and legal services related to energy. Included in these sectors are the following sub-technologies that are considered to be clean energy-specific for the purposes of this report. Note that the U.S Climate Alliance does not have a uniform definition of clean energy and this list includes some technologies that would not be defined as clean energy technologies by some member states. In general, technology definitions are largely similar across other reports from state agencies or national organizations, particularly for the grid modernization and storage and energy efficiency sectors. Technology differences are largely related to the inclusion or exclusion of sub-technologies in other sectors such as clean energy generation, clean fuels, and alternative transportation.

Other clean energy report estimates may vary based on decisions to either include or exclude specific sub-technologies as part of the clean energy economy, such as nuclear fuels and generation, traditional hydropower, corn ethanol, etc. The state-specific fact sheets follow different definitions based on state policy frameworks. It should be noted that manually summing jobs across the state fact sheets will not total to the cumulative values in this main report as state-specific definitions of clean energy may differ from the technologies considered in this report.

CLEAN ENERGY GENERATION

- Solar photovoltaic
- Concentrated solar
- Wind
- Geothermal
- Bioenergy/Biomass
- Low-Impact hydroelectric, including wave/kinetic
- Traditional hydroelectric
- Nuclear
- Combined heat and power
- Other clean energy generation

GRID MODERNIZATION AND STORAGE

- Smart grid
- Microgrids
- Other grid modernization
- Pumped hydro-power storage
- Battery storage, including battery storage for solar generation
  - Lithium batteries
  - Lead-based batteries
  - Other solid-electrode batteries
  - Vanadium redox flow batteries

        - Other flow batteries
    - Mechanical storage (flywheels, compressed air energy storage, etc.)
    - Thermal storage, excluding fossil-related
    - Biofuels, including ethanol and biodiesel
    - Nuclear fuel

ENERGY EFFICIENCY

- ENERGY STAR Certified Appliances, excluding HVAC
- ENERGY STAR Certified Heating Ventilation and Air Conditioning (HVAC), including boilers and furnaces with an AFUE rating of 90 or greater and air and central air conditioning units of 15 SEER or greater
- Traditional HVAC goods, control systems, and services
- ENERGY STAR Certified Electronics (TVs, Telephones, Audio/Video, etc.)
- ENERGY STAR Certified Windows and Doors
- ENERGY STAR Certified Roofing
- ENERGY STAR Certified Seal and Insulation
- ENERGY STAR Certified Commercial Food Service Equipment
- ENERGY STAR Certified Data Center Equipment
- ENERGY STAR Certified LED Lighting
- Other LED, CFL, and Efficient Lighting
- Solar thermal water heating and cooling
- Other renewable heating and cooling (geothermal, biomass, heat pumps, etc.)
- Advanced building materials/insulation
- Recycled building materials
- Reduced water consumption products and appliances
- Other energy efficiency

CLEAN FUELS

- Corn ethanol
- Other ethanol/non-woody biomass, including biodiesel
- Woody biomass/cellulosic biofuel
- Other biofuels
- Nuclear fuel
- Other clean fuels

ALTERNATIVE TRANSPORTATION

- Plug-In Hybrid Vehicles
- Electric Vehicles
- Natural Gas Vehicles
- Hydrogen Vehicles
- Fuel Cell Vehicles
- Other Clean Vehicles

UNITED STATES
CLIMATE ALLIANCE

Photo: Walnut Beach by Derek Story

State Clean Energy Jobs Fact Sheet 2016-2019

CONNECTICUT

Connecticut continues to implement steps to reach its short- and long-term greenhouse gas reduction goals. The state has become more energy efficient by establishing a lead-by-example approach, helping reduce the state's carbon and environmental footprint while decreasing the cost of government operations. The state also enacted a requirement to seek up to 2 gigawatts of offshore wind power over the next 11 years. In the transportation sector, Connecticut is dedicated to growing the number of zero-emission vehicles on the road.

Clean Energy Job Growth (2016-19)

7.3%

Total Clean Energy Jobs in 2019

44,094

(Figure 1)

Largest Clean Energy Industries

High Efficiency HVAC & Renewable Heating & Cooling

Traditional HVAC

(Table 1)

Fastest Growing Clean Energy Industries

Traditional HVAC

ENERGY STAR® & Efficient Lighting

(Table 2)

This fact sheet was produced by BW Research on behalf of the U.S. Climate Alliance. Jobs metrics presented for individual states in the appendix are consistent with the policy definitions of clean energy technologies for the respective states. Therefore, aggregated values from the appendix will differ slightly from cumulative values shown in the main report. It should be noted that employment totals represent the last quarter of 2019, before the onset of the global Coronavirus (COVID-19) pandemic. For more information on COVID-19 impacts to the energy and clean energy industries, please see www.bwresearch.com/covid.

The state is continuing to improve resilience in vulnerable communities along its coast by addressing both critical infrastructure and sea-level rising. Connecticut is also actively working to phase out the use of high-warming hydrofluorocarbons to reduce climate pollution, as well as to protect vital land including parks, forests, and wildlife areas.

Connecticut climate policy can and should be part of the state's economic recovery. The U.S. Climate Alliance 2020 Clean Energy Employment Report indicates that this is possible, and that reducing the state's greenhouse gas emissions, with the right attention to job quality and access, can provide opportunity for Connecticut residents as they rebuild their economy.

Figure 1. Connecticut Clean Energy Jobs Growth, 2016-2019

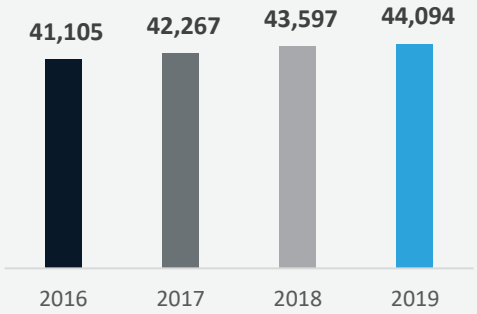


Table 1. Top 10 Clean Energy Industries by Employment, Pre-COVID-19

Industry	2019 Total Clean Energy Jobs
High Efficiency HVAC & Renewable Heating & Cooling	10,619
Traditional HVAC	8,840
ENERGY STAR & Efficient Lighting	8,373
Other Energy Efficiency Technologies	4,523
Advanced Materials	3,646
Solar Electric Power Generation	2,839
Nuclear Electric Power Generation	1,256
Hybrid Electric Vehicles	860
Electric Vehicles	433
Plug-In Hybrid Vehicles	391

Table 2. Top 10 Largest Growth Clean Energy Industries, Pre-COVID-19

Industry	Jobs Added 2016-2019
Traditional HVAC	958 (+12.2%)
ENERGY STAR & Efficient Lighting	872 (+11.6%)
High Efficiency HVAC & Renewable Heating & Cooling	509 (+5.0%)
Bioenergy & Combined Heat & Power	191 (+128.2%)
Microgrid	182 (+424.2%)
Wind Electric Power Generation	175 (+1604.4%)
Advanced Materials	134 (+3.8%)
Other Grid Modernization	126 (+212.8%)
Hybrid Electric Vehicles	98 (+12.9%)
Plug-In Hybrid Vehicles	85 (+27.7%)

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MEMORANDUM

To: **Bryan Garcia, Connecticut Green Bank**

From: **Sarah Lehmann, BW Research**

Date: **14 December 2020**

Re: **COVID-19 Clean Energy Job Losses in Connecticut (through November)**

OVERALL CLEAN ENERGY JOB LOSSES

Overall, clean energy employment in Connecticut has declined by 10.9 percent compared to the last quarter of 2019. Clean energy jobs recovery has been slow from June through November (+1,751 workers). Clean energy employment across the state still remains about 1,100 jobs below the overall total at the end of 2015.

To date, BW Research estimates that there are roughly 39,300 clean energy workers in Connecticut, about 4,800 fewer than the last quarter of 2019.

Figure 1. Clean Energy Employment in Connecticut, Q4 2015 – November 2020

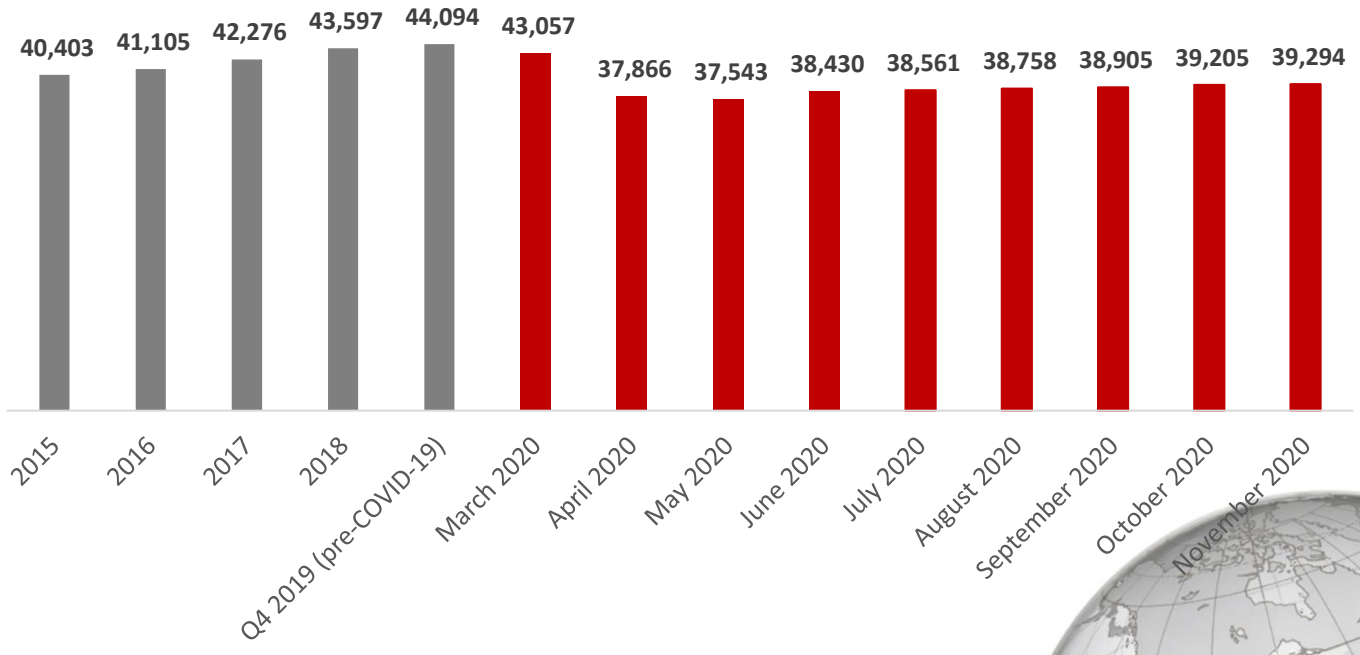

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Table 1. Monthly and Cumulative Clean Energy Jobs Losses, March – November

	Monthly Job Change	Cumulative Job Losses
March	(1,037)	(1,037)
April	(5,191)	(6,228)
May	(323)	(6,551)
June	887	(5,664)
July	131	(5,533)
August	197	(5,337)
September	148	(5,189)
October	300	(4,889)
November	89	(4,800)

JOB LOSSES BY TECHNOLOGY SECTOR

The energy efficiency sector accounted for about 85 percent of jobs lost from March through November. Clean energy generation firms accounted for about one in ten job losses (8.0 percent), followed by alternative transportation (4.3 percent of cumulative job losses), clean grid and storage (1.9 percent), and clean fuels (1.0 percent).

Energy efficiency businesses rebounded slightly from June through November, adding back roughly 1,430 workers. Over the same time, clean energy generation firms regained about 170 jobs. BW Research estimates that the solar sub-sector has lost approximately 325 jobs as of November—an 11.4 percent decline compared to the 2,839 solar jobs at the end of 2019.

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Figure 2. Cumulative Clean Energy Job Losses by Technology Sector (through November)

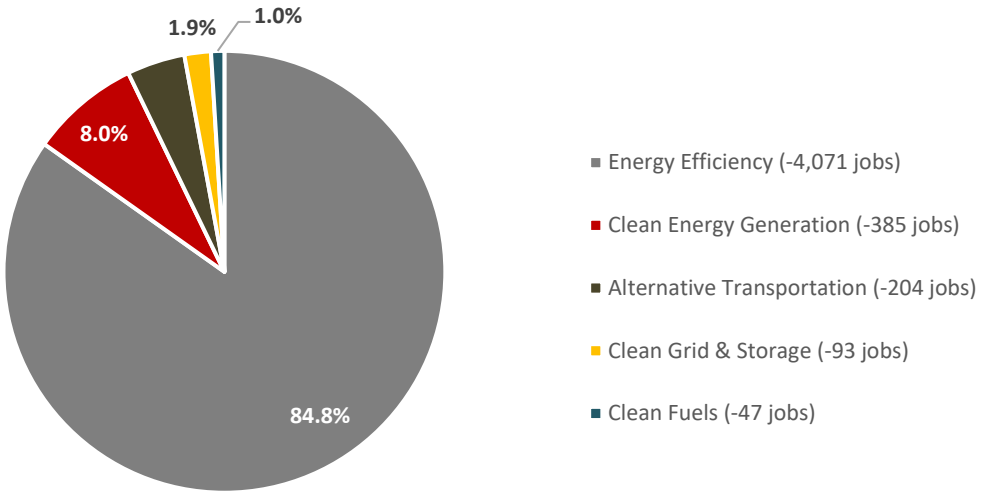
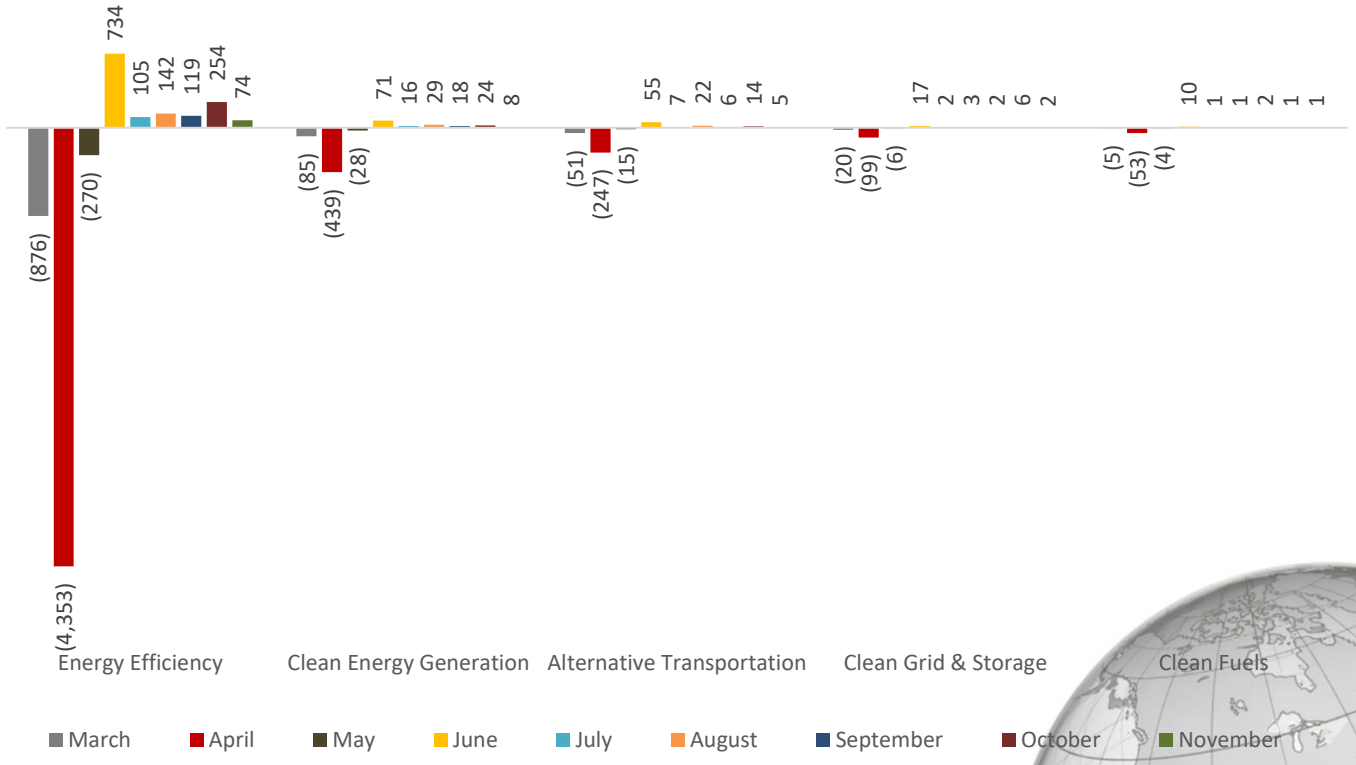


Figure 3. Clean Energy Job Losses by Technology Sector, March – November



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While the energy efficiency sector has seen the greatest absolute loss in number of jobs, clean grid and storage firms saw the highest proportion of clean energy job losses compared to the 2019 employment baseline—a 12.2 percent decline.

Table 2. Clean Energy Job Losses, % of Total Jobs by Technology Sector

	2019 Jobs	Cumulative Losses March - November	% of Jobs Lost
Energy Efficiency	36,000	(4,071)	-11.3%
Clean Energy Generation	4,830	(385)	-8.0%
Alternative Transportation	1,865	(204)	-11.0%
Clean Grid & Storage	761	(93)	-12.2%
Clean Fuels	638	(47)	-7.3%

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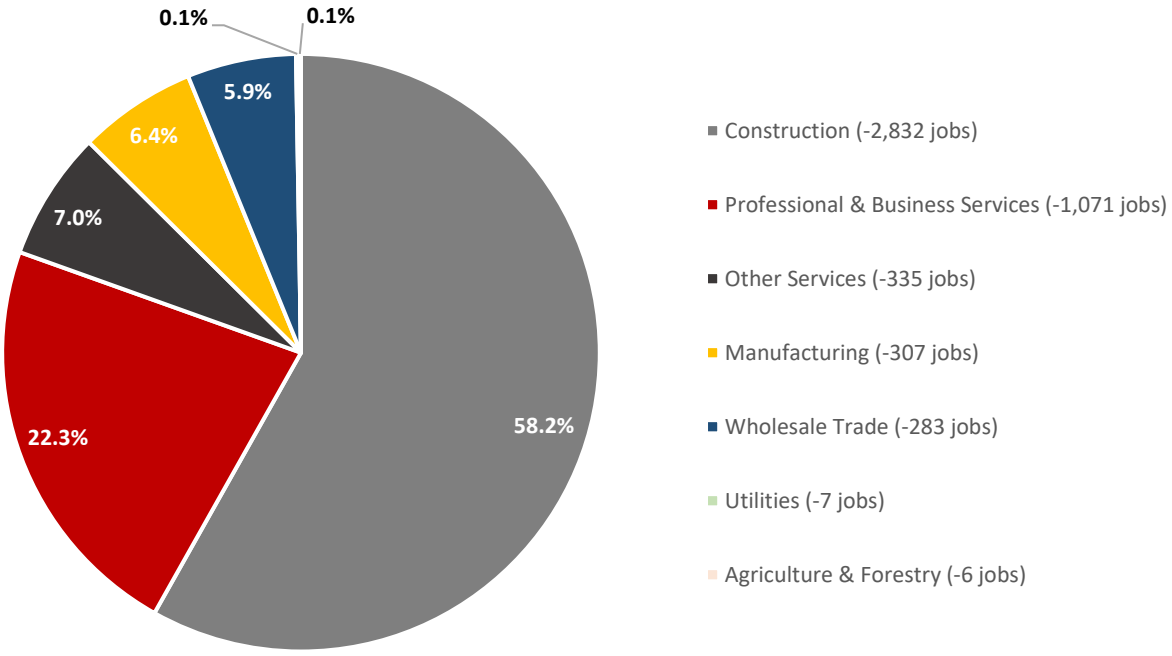
JOB LOSSES BY VALUE CHAIN SECTOR

The construction industry accounted for about six in ten of total jobs lost (58 percent) from March through November. Professional and business services accounted for about a quarter of total job losses (22 percent) over the same time. Other services, which largely includes automotive repair and maintenance, accounted for roughly seven percent of cumulative job losses while the clean energy manufacturing industry represented about six percent of job losses as of November.

Construction and professional services each added back a respective roughly 802 and 533 jobs back to the clean energy industry from June through November.

Figure 4. Cumulative Clean Energy Job Losses by Value Chain Sector (through November)



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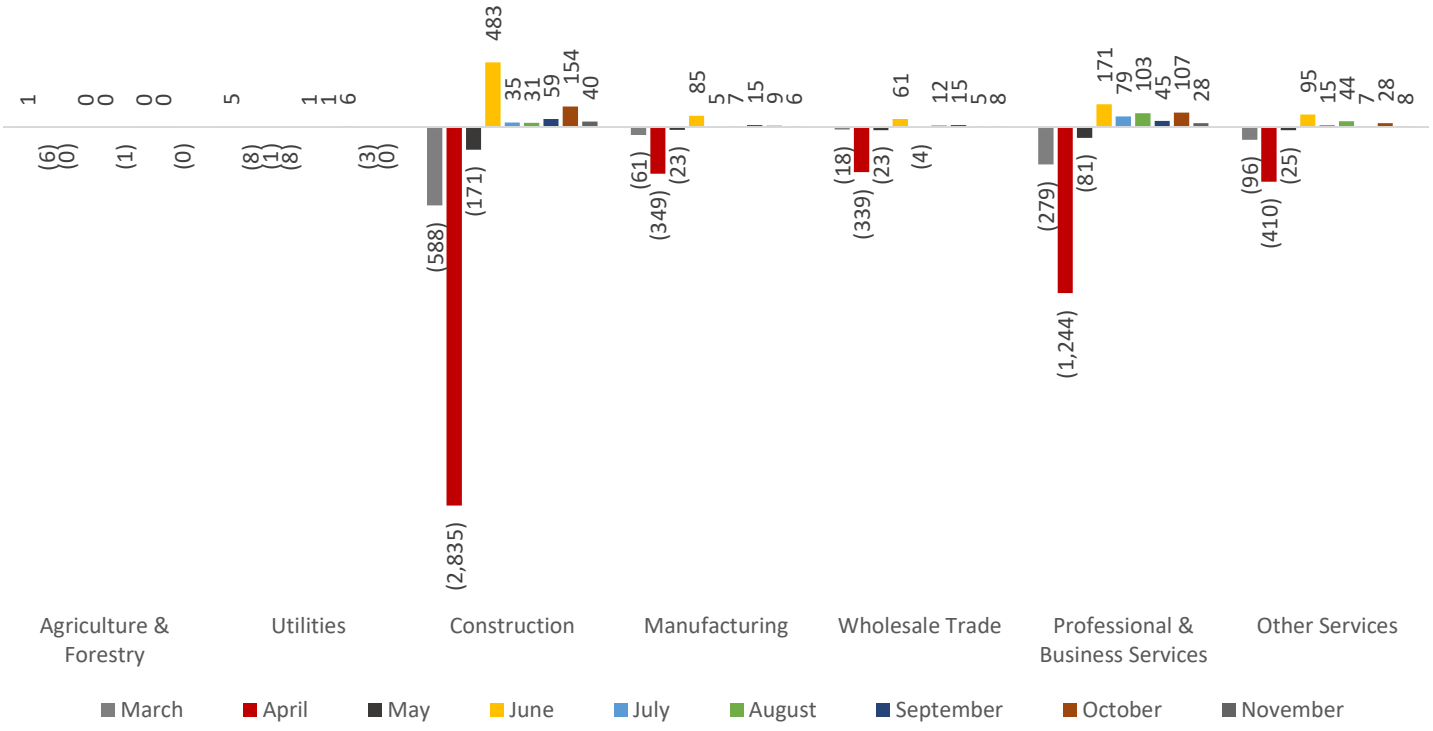
MEMORANDUM

Figure 5. Clean Energy Job Losses by Value Chain Sector, March – November



As of November 2020, the clean energy construction industry sector had seen both the greatest absolute and proportional job loss—shedding a cumulative 2,830 jobs—a 14 percent decline compared to the 2019 basline.

Table 3. Clean Energy Job Losses, % of Total Jobs by Value Chain Sector

	2019 Jobs	Cumulative Losses March - November	% of Jobs Lost
Agriculture and Forestry	59	(6)	-10.0%
Utilities	1,186	(7)	-0.6%
Other Services	2,488	(335)	-13.5%
Manufacturing	3,213	(307)	-9.5%
Trade	5,145	(283)	-5.5%
Professional & Business Services	12,237	(1,071)	-8.8%
Construction	19,767	(2,792)	-14.1%

Comprehensive Plan

Green Bonds US

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Comprehensive Plan

Fiscal Year 2020 & Beyond

July 2019 (FY20)

Revised July 2020 (FY21)

Table of Contents

1. Executive Summary

> *"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."*
>
> *Alexis de Tocqueville, Democracy in America*

Although Connecticut is one of the smallest states in the country, its decades of legislative leadership on climate change has had an influential impact across the country and around the world. One example of this was on July 1, 2011, when in a bipartisan manner, Public Act 11-80[1] was passed. Within Section 99 of that seminal act, the nation's first state-level green bank was formed. The Connecticut Green Bank ("the Green Bank") is a public policy innovation, a catalyst that helps mobilize greater local and global investment to address climate change.

Since its inception, the Green Bank has mobilized nearly $1.7 billion of investment into Connecticut's clean energy economy at nearly a 7 to 1 leverage ratio of private to public funds, supported the creation of over 20,000 direct, indirect, and induced job-years, reduced the energy burden on over 40,000 families (in particular low-to-moderate income families) and businesses, deployed nearly 360 MW of clean energy that will help avoid over 5.8 million tons of CO_2 emissions and save over $200 million of public health costs over the life of the projects, and helped generate $87.1million in individual income, corporate, and sales tax revenues to the State of Connecticut.[2]

As a result of the Green Bank's success as an integral public policy tool addressing climate change in Connecticut, there has been growing national public policy interest at the local,[3] federal,[4] and international[5] levels to realize similar results. This green bank movement is about increasing and accelerating the flow of private capital into markets that energize the green economy to confront climate change and provide all of society a healthier, more prosperous future. As the "spark" to the green bank movement, the Green Bank was awarded the prestigious 2017 Innovations in American Government Awards by the Ash Center at Harvard University's Kennedy School of Government[6].

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[1] An Act Concerning the Establishment of the Department of Energy and Environmental Protection and Planning for Connecticut's Energy Future.

[2] FY19 Comprehensive Annual Financial Report

[3] American Green Bank Consortium – https://greenbankconsortium.org/

[4] US Green Bank Act of 2019 introduced by Senators Blumenthal (CT), Markey (MA), Murphy (CT), Van Hollen (MD), and Whitehouse (RI) in the Senate, National Climate Bank Act of 2019 introduced by Senators Markey (MA) and Van Hollen (MD), with co-sponsors Blumenthal (CT) and Schatz (HI), the US Green Bank Act of 2019 by Representative Himes (CT) and 13 others in the House. Democratic Presidential Candidates Inslee and Bennet proposed $90 billion and $1 trillion "green bank" and "climate banks," respectively as part of their campaigns.

[5] Green Bank Network – https://greenbanknetwork.org/

[6] https://ash.harvard.edu/news/connecticut-green-bank-awarded-harvards-2017-innovations-american-government-award

At home and abroad, there is agreement that accelerating the flow of capital into the green economy is one key to addressing the climate crisis. The Paris Agreement's third aim (beyond mitigation of greenhouse gas emissions and adaptation to climate change impacts) is making finance flows consistent with a pathway towards reduced emissions and increased climate resilient development. The Center for American Progress estimates that the U.S. needs at least $200 billion in renewable energy and energy efficiency investment a year for 20 years to reduce carbon emissions and avert climate disaster.[7] In a similar vein, the United Nations estimates that $90 trillion of investment is needed over the next 15 years to advance sustainable development and confront the worst effects of climate change.[8]

To put these numbers into perspective, this is the equivalent of between $620 to $800 of investment per person per year for the next 15 years, respectively – or, the equivalent of nearly $3 billion a year of investment in Connecticut's green economy!

Faced with the magnitude of investment required to put society on a more sustainable path to confront climate change, the Green Bank convened a group of stakeholders at the Pocantico Conference Center of the Rockefeller Brothers Fund in February of 2019 for a two-day strategic retreat entitled "Connecticut Green Bank 2.0 – From 1 to 2 Orders of Magnitude". Having convened at the Pocantico Conference Center in November of 2011 to establish the Green Bank's first strategic plan (i.e., Green Bank 1.0), this new group of stakeholders met to reflect on the past seven years and then to envision an even bigger future for the Green Bank (i.e., Green Bank 2.0) consistent with the larger investment required.[9]

The retreat identified several key findings and recommendations for the Green Bank, including:

- **Commitment to Address Climate Change** – as the most urgent issue to address, the Green Bank needs to increase and accelerate the impact of its model to support the implementation of Connecticut's climate change plan;[10]
- **Scaling Up Investment and Impact in Connecticut and Beyond** – in order to achieve the climate change goals set forth, more investment from private capital sources leveraged by innovative public sector financing will be needed to scale-up and scale-out the green bank model's impact; and
- **Green Bonds to Increase Access to Capital** – with the ability to issue bonds, the Green Bank is able to increase its access to capital beyond the current sources of funding to scale-up its investment activity, while providing more opportunities to engage citizens in new ways to invest in the state's growing green economy, including through the issuance

[7] "Green Growth: A U.S. Program for Controlling Climate Change and Expanding Job Opportunities" by the Center for American Progress (September 2014).

[8] "Financing Sustainable Development: Moving from Momentum to Transformation in a Time of Turmoil" by the UNEP (September 2016).

[9] "Connecticut Green Bank 2.0 – From 1 to 2 Orders of Magnitude" at the Pocantico Conference Center of the Rockefeller Brothers Fund (February 6-7, 2019)

[10] "Building a Low Carbon Future for Connecticut – Achieving a 45% GHG Reduction by 2030" recommendations from the Governor's Council on Climate Change (December 18, 2018)

of “mini green bonds” (i.e., bonds with denomination values of $1,000 or less) that will engage citizens in making investments alongside the Green Bank.

Increasing and accelerating investment in the green economy by using limited public resources to attract and mobilize multiples of private capital investment is paramount to society’s efforts to pursue sustainable development, while confronting climate change. More investment in the green economy creates more jobs in our communities, reduces the burden of energy costs on our families and businesses (especially the most vulnerable), and reduces fossil fuel pollution that causes local public health problems and global climate change.

Investment for the sake of investment is not enough unless we have an engaged citizenry that is active in communities across the state! Whether through markets or within communities in partnership with other community-based organizations, the Green Bank is bringing people together and strengthening the bonds we share with one another. In order to confront climate change and provide all of society a healthier and more prosperous future by increasing and accelerating the flow of private capital into markets that energize the green economy, the Green Bank is launching the “Green Bonds US” campaign, that seeks to promote a simple but critically important message; green brings us together, green bonds us.

As the cover to the Comprehensive Plan of the Green Bank suggests, by making clean energy more accessible and affordable to everyone – Green Bonds US – society will reap significant gains from moving forward in the same direction together – for we can’t have environmentalism without humanitarianism.

2. Organizational Overview

The Green Bank[11] was established by Governor Malloy and Connecticut’s General Assembly on July 1, 2011 through Public Act 11-80 as a quasi-public agency that supersedes the former Connecticut Clean Energy Fund (“CCEF”). As the nation’s first state green bank, the Green Bank leverages public and private funds to drive investment and scale-up clean energy deployment in Connecticut.

The Green Bank’s statutory purposes are:

- To develop programs to finance and otherwise support clean energy 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 to foster the growth, development and commercialization of clean energy sources and related enterprises; and

[11] Public Act 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.

- To stimulate demand for clean energy and the deployment of clean energy sources 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 nearly two-decade history of bipartisan gubernatorial leadership on the issue of climate change. Other 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 emissions (i.e., 1990 levels by 2010, 10% below 1990 levels by 2020, and 80% below 2001 levels by 2050);[12]
- **Governor Rell** – supported Public Act 08-98[13] codifying the regional commitment into state law, appointing Gina McCarthy to be the Commissioner of the Department of Environmental Protection who would help lead the development of the Regional Greenhouse Gas Initiative and later become the EPA Administrator under President Obama leading the development of the Clean Power Plan and the U.S. participation in the Paris Agreement;
- **Governor Malloy** – led the passage of PA 11-80 establishing the Department of Energy and Environmental Protection ("DEEP"), creating the Green Bank, and other policies catalyzing the market for clean energy, as well as Public Acts 18-50[14] and 18-82[15] increasing the state's renewable portfolio standard to 40% by 2030 and establishing a midterm greenhouse gas emissions reduction target of 45% below 2001 levels by 2030, respectively; and
- **Governor Lamont** – his campaign plan for Connecticut[16] seeks to achieve carbon neutrality by 2050 and setting a 100% renewable portfolio standard by 2050 which would help the state realize green jobs in energy efficiency and clean energy (e.g., fuel cells, offshore wind, solar PV, etc.), while reducing energy costs.

The Connecticut General Assembly 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 and lead the movement on climate change action.

2.1 Vision

...a world empowered by the renewable energy of community.

[12] NEG-ECP Resolution 26-4 adopting the "Climate Change Action Plan 2001" (August 2001 in Westbrook, CT)
[13] An Act Concerning Connecticut Global Warming Solutions
[14] An Act Concerning Connecticut's Energy Future
[15] An Act Concerning Climate Change Planning and Resiliency
[16] Ned's Plan for Connecticut – Addressing Climate Change & Expanding Renewable Energy

2.2 Mission

Confront climate change and provide all of society a healthier and more prosperous future by increasing and accelerating the flow of private capital into markets that energize the green economy.[17]

2.3 Goals

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

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 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, mission, and goals support the implementation of Connecticut's clean energy policies be they statutorily required (e.g., CGS 16-245ff), planning (e.g., Comprehensive Energy Strategy), or regulatory (e.g., Electric Efficiency Partners Program, Docket No. 17-12-03) in nature.

2.4 Definition – Clean Energy

The Green Bank's investment focus is on "clean energy" 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 derived from agricultural produce, food waste or waste vegetable oil, provided the Commissioner of Energy and Environmental Protection determines that such fuels provide net reductions in greenhouse gas emissions and fossil fuel consumption, usable electricity from combined heat and power systems with waste heat recovery systems, thermal storage systems, other energy resources and emerging technologies which have significant potential for commercialization and which do not involve the combustion of coal, petroleum or petroleum products, municipal solid waste or nuclear fission, financing of energy efficiency projects, projects that seek to deploy electric, electric hybrid, natural gas or alternative fuel vehicles and associated infrastructure, any related storage, distribution, manufacturing technologies or facilities and any Class I renewable energy source, as defined in section 16-1.

[17] 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, Governors Malloy's and Lamont's Council on Climate Change, and many other past acts, plans, or policies.

3. Governance and Organizational Structure

The Green Bank is overseen by a governing Board of Directors comprised of ex officio and appointed members, while the organization of the Green Bank is administered by a professional staff overseeing two business units – Incentive Programs and Financing Programs.

3.1 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[18] that is comprised of eleven voting and one non-voting members each with knowledge and expertise in matters related to the purpose of the organization – see Table 1.[19]

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
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

There are four (4) committees of the Board of Directors of the Green Bank, including Audit, Compliance and Governance Committee, Budget, Operations, and Compensation Committee, Deployment Committee, and the Joint Committee of the Energy Efficiency Board ("EEB") and the Green Bank.[20]

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 Board of Directors 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

[18] https://www.ctgreenbank.com/about-us/governance/board-of-directors/
[19] https://www.ctgreenbank.com/about-us/governance/
[20] Pursuant to Section 16-245m(d)(2) of the Connecticut General Statutes

Bylaws, and a Comprehensive Plan. All meetings, agendas, and materials of the Green Bank's Board of Directors and its Committees are publicly available on the organization's website.[21,22]

3.2 Organizational Structure

The organizational structure of the Green Bank is comprised of two (2) business units, including:

- **Incentive Programs** – the Governor and the Connecticut General Assembly from time-to-time may decide that there are certain incentive (or grant) programs that they seek to have the Green Bank administer (e.g., CGS 16-245ff). 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. For example, the Green Bank administers the Residential Solar Investment Program ("RSIP") whereby through a declining incentive block structure no more than 350 MW of new residential solar PV systems are deployed, while nurturing the sustained orderly development of a local state-based solar PV industry. Through the public policy creation of a Solar Home Renewable Energy Credit ("SHREC"), the Green Bank is able to recover its costs for administering the RSIP by selling such credits to the Electric Distribution Companies ("EDCs") through a Master Purchase Agreement ("MPA") to support their compliance under the Class I Renewable Portfolio Standard ("RPS"). Costs recovered from such mechanisms are expected to cover the incentive, administrative expenses, and financing expenses of the Incentive Programs business unit.
- **Financing Programs** – the Green Bank's core business is financing projects. The Green Bank's focus is to leverage limited public funds to attract and mobilize multiples of private capital investment to finance clean energy projects. In other words, the use of resources by the Green Bank are to be invested with the expectation of principal and interest being paid back over time. For example, 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 improvements on their properties that is paid back over time from a benefit assessment on the building owner's property tax bill. The interest from these types of investments, over time, is expected to cover the operational expenses and a return for the Financing Programs business unit.

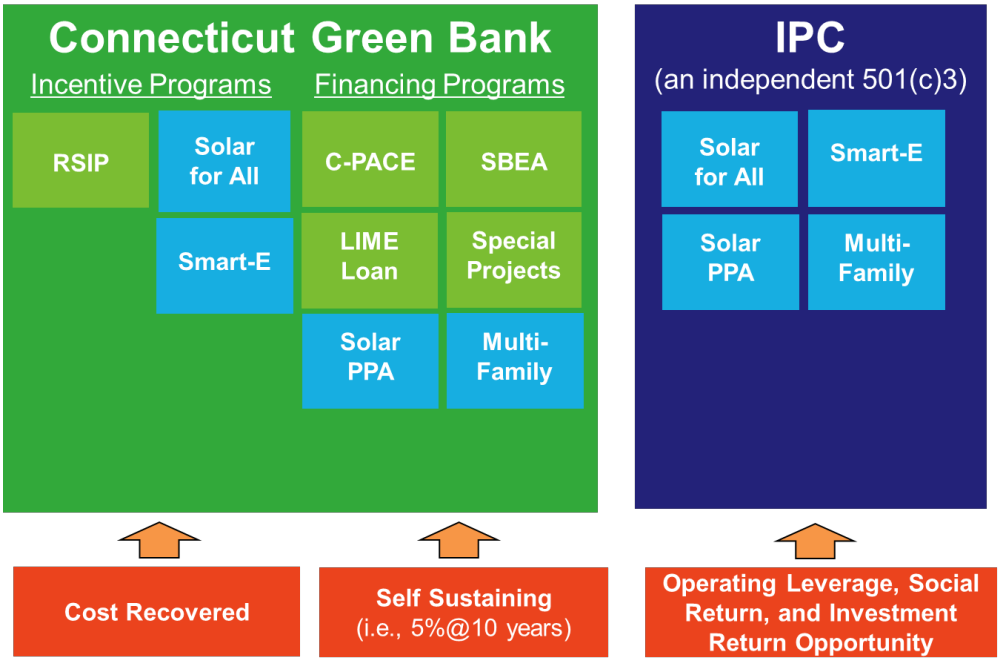
These two business units – Incentive Programs and Financing Programs – serve the purposes of the Green Bank. To support the business units and their investments, the Green Bank has administrative support from finance, legal, marketing and operations.

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

[21] http://www.ctgreenbank.com/about-us/board-member-resources/connecticut-grboard-meetings/
[22] http://www.ctgreenbank.com/about-us/board-member-resources/connecticut-grittee-meetings/

In 2018, 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 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 the goals of Connecticut public policy by administering programs on behalf of the Green Bank. 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



4. Incentive Programs

The Green Bank manages incentive programs. That is to say that it oversees grant or subsidy program(s) (including credit enhancements – interest rate buydowns and loan loss reserves) that deploy clean energy, while at the same time cost recovering the expenses associated with those programs within the business unit – including, but not limited to, incentives, administrative expenses, and financing expenses, as well as loan loss reserves on the balance sheet.

Per CGS 16-245ff, updated by Public Act 19-35[23], the Green Bank administers the RSIP that includes a declining incentive block structure to deploy no more than 350 megawatts of new residential solar PV systems on or before December 31, 2022, while ensuring the sustained orderly development of a local state-based solar PV industry. The RSIP also requires that participating households undergo a Home Energy Solutions assessment, or equivalent audit. It should be noted that the Green Bank has also strategically sought to ensure that low-to-moderate income

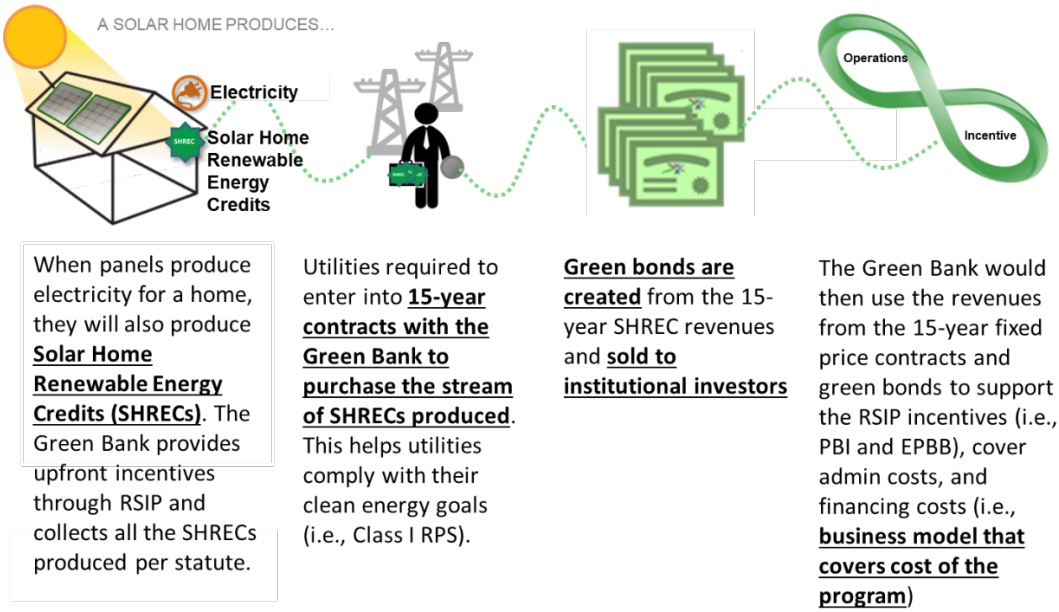
[23] An Act Concerning a Green Economy and Environmental Protection

households have equal access to residential solar PV than non-low-to-moderate income households.[24] Through the Solar for All program, the Green Bank and its partners are enabling low-to-moderate income households to reach "solar parity" such that the proportion of solar PV installed on low-to-moderate income households is no less than non-low-to-moderate income households.

As of June 1, 2020, 326 megawatts of residential solar PV systems have been approved through RSIP, supporting 40,821 projects across the state and nearly $1.24 billion of investment.[25]

To support the Green Bank's implementation of the RSIP, the EDCs are required to purchase the SHRECs to assist them in their compliance with the RPS. The SHREC price is established by the Green Bank to recover its costs for administering the RSIP through a 15-year MPA with the EDCs. The cash flow from the sale of current and future SHRECs produced by these systems can be sold as a "green bond"[26] to generate cash flow upfront to support the cost recovery of the program – see Figure 2.

Figure 2. Incentive Program – Overview of the RSIP and the SHREC

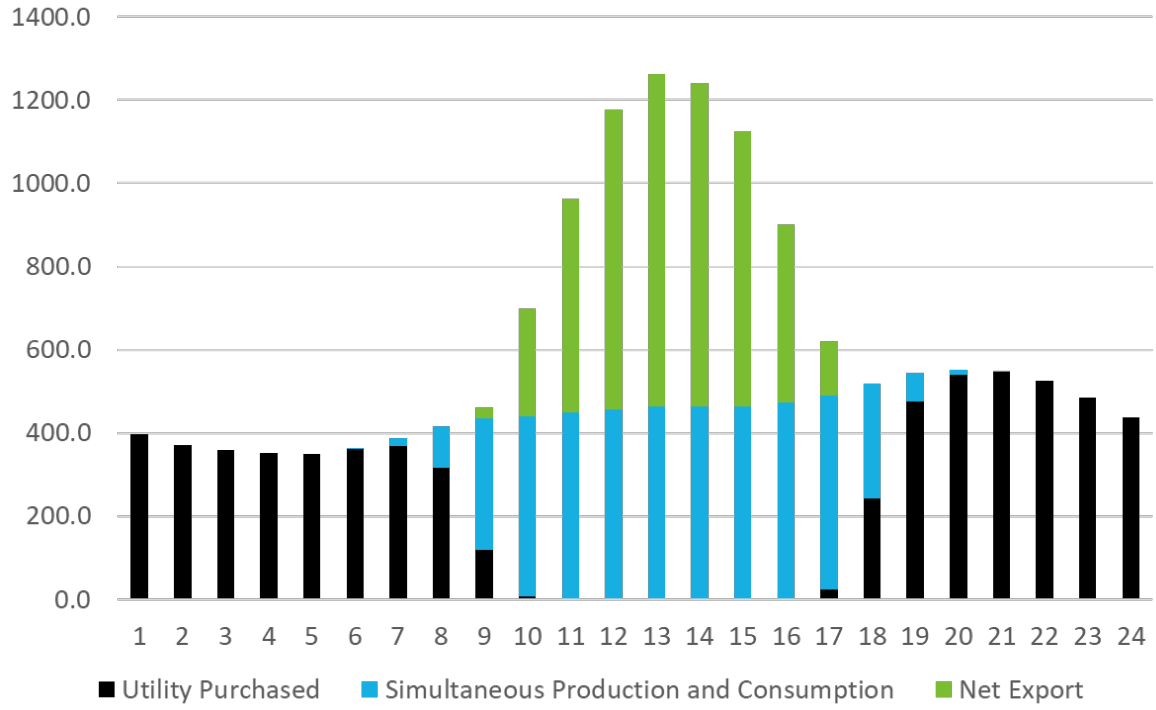


The Green Bank, through its partner C-Power, aggregates and registers residential solar PV systems in ISO-NE's On-Peak Hours Resource Program for which it receives Forward Capacity Market payments.[27]

[24] Sharing Solar Benefits – Reaching Households in Underserved Communities of Color in Connecticut by the Connecticut Green Bank (May 2019) – click here.
[25] Prior to the RSIP, through incentives provided by the Connecticut Clean Energy Fund, the predecessor of the Green Bank, there are another 2,018 residential solar PV projects totaling 13.4 MW.
[26] https://www.ctgreenbank.com/cgb-enters-green-bond-market/
[27] https:///www.iso-ne.com/markets-operations/markets/forward-capacity-market

In general, over the course of a year, a typical residential solar PV system produces, and the household simultaneously consumes, about fifty percent of the production from the system – meaning that about fifty percent of the system's production is being exported to the grid – see Figure 3.

Figure 3. Average Residential Consumption and Solar PV Production Over the Course of a Year by Hour of the Day



In order to store the system's production that would have been exported to the grid for the purposes of later using it for (1) back-up power that would benefit the household, and/or (2) reducing demand, specifically peak demand, that would benefit all ratepayers, in FY 2019, the Green Bank submitted an application into the Electric Efficiency Partners Program (EEPP) (i.e., Docket No. 18-12-35) demonstrating the "cost effectiveness" of residential solar PV in combination with battery storage.[28] In FY 2021, the Green Bank will also be submitting into the Public Utility Regulatory Authority's ("PURA") Equitable Modern Grid process (i.e., Docket No. 17-12-03(RE03), an incentive program with a focus on combined residential solar PV and battery storage. In collaboration with DEEP and the EDCs through the Joint Committee,[29] efforts are being made to enable residential solar PV in combination with battery storage to deliver greater benefits to participating households as well as all ratepayers on the electric grid – through a combination upfront incentive in support of passive demand response in conjunction with a performance-based incentive in support of active demand response.

[28] Section 94 of Public Act 07-242
[29] Pursuant to Section 16-245m(d)(2) of the Connecticut General Statutes

The EnergizeCT Smart-E Loan in partnership with local community banks and credit unions, provides easy access to affordable capital for homeowners to finance energy, as well as health & safety, improvements on their properties through a partnership between local contractors and financial institutions, IPC, and the Green Bank. As the Green Bank provides credit enhancements to the Smart-E Loan in the form of interest rate buydowns (i.e., subsidy) and loan loss reserves from its balance sheet, it is considered an incentive program since there is no direct financial return (e.g., principal and interest) to the organization like financing programs.

The Green Bank has set targets for its Incentive Programs business unit for FY 2020[30] and FY 2021 in terms of the number of projects, total investment (i.e., public and private), and installed capacity – see Tables 2 and 3.

Table 2. Revised FY 2020 Targets for the Incentive Programs Business Unit

Program / Product	Projects	Total Investment ($MM's)	Installed Capacity (kW)
Residential Solar Investment Program	7,059	$214.2	60,000
Solar for All Program	615	$17.2	4,200
Electric Efficiency Partners Program[31]	0-500	$0.0-$5.5	0-2,000
EnergizeCT Smart-E Loan	540	$7,2	500
Total[32]	**8,045**	**$225.9**	**62,000**

Table 3. FY 2021 Targets for the Incentive Programs Business Unit

Program / Product	Projects	Total Investment ($MM's)	Installed Capacity (kW)	Ann. GHG Emissions Avoided (TCO2)
Residential Solar Investment Program	2,824-4,706	$85.9-$143.2	24,000-40,000	15,107-25,178
Solar for All Program	177-304	$4.3-$7.4	1,200-2,000	724-1,246
Equitable Modern Grid[33]	0-400	$0.0-$3.5	0-2,000	-
EnergizeCT Smart-E Loan	270-540	$3.6-$7.1	0.3-0.6	1,972-3,937

[30] Revised by the Board of Directors on January 24, 2020

[31] The Connecticut Green Bank has submitted a Technology Application (i.e., Docket No. 18-12-35) into PURA through the Electric Efficiency Partners Program in support of a residential battery storage incentive program that would retrofit existing residential solar PV systems installed through the RSIP. Beyond existing solar PV systems that could be retrofit with battery storage, RSIP Step 15 proposes a combined residential solar PV and battery storage upfront incentive for new installations that demonstrates significant "cost effectiveness" of distributed energy systems. Meeting this target was contingent upon PURA's determination in Docket No. 18-12-35. There was not yet a determination by PURA in the docket, and therefore the revision.

[32] The total does not count Solar for All and Smart-E Loan solar PV projects separately because they are also RSIP projects and therefore already counted.

[33] The Connecticut Green Bank will be submitting a proposal into Docket No. 17-12-03(RE03) – Electric Storage. Should the Request for Proposed Designs ("RFPD") be accepted by PURA, then the Green Bank would anticipate administering an upfront electric storage incentive program beginning January 1, 2021.

Program / Product	Projects	Total Investment ($MM's)	Installed Capacity (kW)	Ann. GHG Emissions Avoided (TCO2)
Total[34]	3,462-5,581	$92.6-$153.0	26,000-42,000	16,877-28,712

Starting in FY 2021, the Green Bank has added annual GHG emissions avoided as a target for its Incentive Programs. It should be noted that there are two factors impacting the FY 2021 targets for the RSIP – COVID-19 impacts on market demand and achieving the 350 MW target[35] – and therefore, the low and high range for the targets.

As a result of successfully achieving these targets, the Green Bank will reduce the energy burden on Connecticut families (including low-to-moderate income households and communities of color, as well as ratepayers by reducing demand, specifically peak demand, through the use of solar PV and battery storage), 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.

5. Financing Programs

The Green Bank manages financing programs. That is to say that it oversees financing programs that provide capital upfront to deploy clean energy, while at the same time returning principal and interest over time from the financing of projects, products, or programs to ensure the financial sustainability of the business unit.

The Green Bank has a number of clean energy financing products, including:

- Commercial Property Assessed Clean Energy ("C-PACE")[36] – enables building owners to pay for clean energy improvements over time through a voluntary benefit assessment on their property tax bills. This process makes it easier for building owners to secure low-interest capital to fund energy improvements and is structured so that energy savings more than offset the benefit assessment.
- Green Bank Solar PPA – third-party ownership structure to deploy solar PV systems for commercial end-use customers (e.g., businesses, nonprofits, municipal and state governments, etc.) that uses a multi-year Power Purchase Agreement ("PPA") to finance projects while reducing energy costs for the host customer.
- Small Business Energy Advantage ("SBEA") – Eversource Energy administered on-bill commercial energy efficiency loan program for small businesses, in partnership with low-cost capital provided by Amalgamated Bank with a credit enhancements from the Green

[34] The total does not count Solar for All and Smart-E Loan solar PV projects separately because they are also RSIP projects and therefore already counted.

[35] Given the devastating impacts of COVID-19 on the local solar industry, the Connecticut Green Bank is proposing an extension to the RSIP should there be a special session in 2020 that takes-up priorities from the Energy & Technology Committee – see April 24, 2020 Board of Directors meeting.

[36] CGS 16a-40g

Bank (i.e., subordinated debt) and the Connecticut Energy Efficiency Fund (i.e., loan loss guaranty and interest rate buydown).

- Multifamily Products – defined as buildings with 5 or more units, the Green Bank provides a suite of financing options through IPC that support property owners to assess, design, fund, and monitor high impact clean energy and health & safety improvements for their properties.
- EV Offset Program – a Research and Development initiative of the Green Bank in FY 2020, now in FY 2021 this program supports the nationwide voluntary carbon offset standard[37] for electric vehicle recharging stations with partner organizations.
- Special Projects – 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 waste to energy, LBE-ESA, etc.). 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.

The Green Bank has set targets for its Financing Programs business unit for FY 2020[38] and FY 2021 in terms of the number of projects, total investment (i.e., public and private), and installed capacity – see Tables 4 and 5.

Table 4. Revised FY 2020 Targets for the Financing Programs Business Unit

Program / Product	Projects	Total Investment ($MM's)	Installed Capacity (kW)
Commercial PACE	56	$25.0	7,000
Green Bank Solar PPA	33	$28.0	12,600
Small Business Energy Advantage[39]	1,000	$20.0	-
Multifamily Predevelopment Loan	2	$0.1	-
Multifamily Term Loan	8	$1.3	200
Multifamily Catalyst Loan	2	$0.1	-
Strategic Investments	2	$7.5	-
Total	1,084	$76.9	17,600

Table 5. FY 2021 Targets for the Financing Programs Business Unit

Program / Product	Projects	Total Investment ($MM's)	Installed Capacity (kW)	Ann. GHG Emissions Avoided (TCO2)
Commercial PACE	33-48	$15.2-$23.3	5,300-7,100	1,452-1,641
Green Bank Solar PPA	30-58	$4.0-$6.8	6,200-11,700	3,940-7,402

[37] https://verra.org/methodology/vm0038-methodology-for-electric-vehicle-charging-systems-v1-0/

[38] Revised by the Board of Directors on January 24, 2020

[39] In partnership with Eversource Energy and Amalgamated Bank, the Connecticut Green Bank provides capital in support of the utility-administered Small Business Energy Advantage program to provide 0% on-bill financing up to 4-years for energy efficiency projects.

Program / Product	Projects	Total Investment ($MM's)	Installed Capacity (kW)	Ann. GHG Emissions Avoided (TCO2)
Small Business Energy Advantage	1,203	$20.4	-	-
Multifamily Predevelopment Loan	1	$0.1	-	-
Multifamily Term Loan	2	$0.2	0.1	68
Multifamily Health & Safety	1	$0.1	-	-
EV Offset Program	-	-	-	17,770
Strategic Investments	3	$7.8	-	-
Total	1,267-1,309	$46.1-$74.5	10,900-18,100	22,684-26,272

Starting in FY 2021, the Green Bank has added annual GHG emissions avoided as a target for its Financing Programs. Given the uncertain impacts of COVID-19, there are low and high range targets proposed.

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 Connecticut families and businesses, 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.

6. Impact Investment

The Green Bank pursues investment strategies that advance market transformation in green investing while supporting the organization's pursuit of financial sustainability. With the mission to confront climate change and provide all of society a healthier and more prosperous future by increasing and accelerating the flow of private capital into markets that energize the green economy, the Green Bank leverages limited public resources to scale-up and mobilize private capital investment in the green economy of Connecticut.

6.1 State Funds

The Green Bank receives public capital from a number of ratepayer and state sources that it leverages to scale-up and mobilize private capital investment in the green economy of Connecticut.

System Benefit Charge – Clean Energy Fund

As its primary source of public capital, the Green Bank through CGS 16-245n(b) receives a 1 mill surcharge called the Clean Energy Fund ("CEF") from ratepayers of Eversource Energy and Avangrid. The CEF has been in existence since Connecticut deregulated its electric industry in the late 1990's.[40] On average, households contribute between $7-$10 a year for the CEF, which

[40] Public Act 98-28 "An Act Concerning Electric Restructuring"

the Green Bank leverages to attract multiples of private capital investment in the green economy of Connecticut.[41]

Regional Greenhouse Gas Emission Allowance Proceeds

As a secondary source of public capital, the Green Bank receives a portion (i.e., 23%) of Connecticut's Regional Greenhouse Gas Initiative ("RGGI") allowance proceeds through the Regulation of Connecticut State Agencies Section 22a-174(f)(6)(B). The Green Bank invests RGGI proceeds from the nation's first cap-and-trade program to finance clean energy improvements (i.e., renewable energy projects).

6.2 Federal Funds

The Green Bank receives public capital through a number of past, current, and future sources[42] 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 nearly $2 million of ARRA funds left,[43] the Green Bank invested over $6.4 million of ARRA funds to attract and mobilize more than $110 million of public and private investment in residential clean energy financing programs.

United States Department of Agriculture

The Green Bank is seeking to apply 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 communities.[44] 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.

6.3 Green Bonds

The future of green bonds is growing in the U.S. Thus far in 2019, countries, companies, and local governments have sold nearly $90 billion of green bonds that fund projects that are good for the environment.[45] In July of 2019, Connecticut Treasurer Shawn Wooden announced that the Clean Water Fund's Green Bond Sale shattered state records. The AAA-rated green bond had a record low interest rate of 2.69% and received retail investor orders topping $240 million in one day! This is the highest level of retail investor orders (i.e., from Separately Managed

[41] 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

[42] 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.

[43] As of July 1, 2019

[44] "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.

[45] "Green Bonds are Finally Sprouting Up All Over the Globe" by Brian Chappatta of Bloomberg News (June 18, 2019)

Accounts (SMA's) or individuals) in the 20-year history of this program – with the balance of the bonds offered to institutional investors generating an additional $128 million in orders.

Green Banks have an essential role in leveraging limited public funds with private capital to drive investment in the green economy to achieve climate change goals, create jobs in our communities, and reduce the burden of energy costs on our families and businesses. CGS Section 16-245n(d)(1)(C) is the enabling statute that allows the Green Bank to issue revenues bonds to support its purposes. Green Bonds are bonds whose proceeds are used for projects or activities with environmental or climate benefits, most usually climate change mitigation and adaptation.

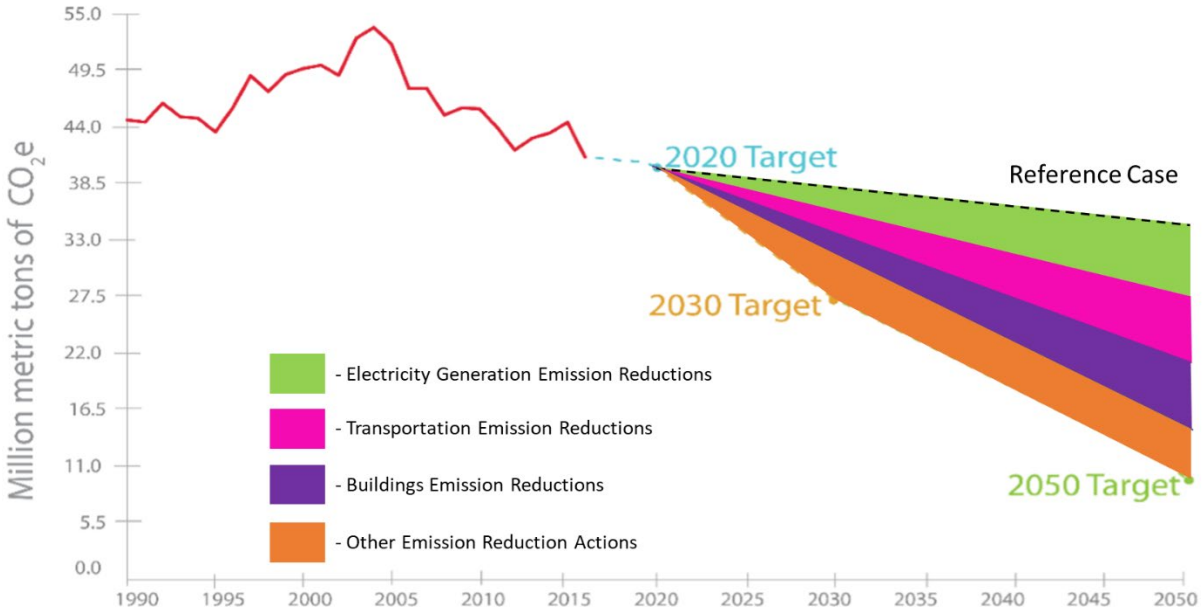
Connecticut's climate change plan[46] focuses on three mitigation wedges (see Figure 4), including:

- **Decarbonizing Electricity Generation** – representing 23% of Connecticut's economy-wide GHG emissions, electricity generation must be transitioned to zero-carbon renewable energy sources. Strategies include financing for in-state or regional utility-scale renewable energy resources (e.g., community solar, wind, run-of-the-river hydro, food-waste-to-energy, etc.) and financing and incentives for in-state distributed energy resources (e.g., behind the meter solar PV, battery storage, fuel cells, combined heat and power, etc.) that assist with the implementation of the Class I and III Renewable Portfolio Standard, Regional Greenhouse Gas Initiative, and other public policies. To ensure a sustainable downward trajectory to meet the State's 2050 target, electricity generation must be 66% and 84% carbon-free by 2030 and 2050, respectively.
- **Decarbonizing Transportation** – representing over 35% of Connecticut's economy-wide GHG emissions, the transportation sector is the largest source of statewide emissions and must be transitioned to zero- and low-carbon technologies. Strategies for zero- and low-carbon transportation include adopting innovative financing models for ZEV deployment (i.e., EVs and FCEVs) and ZEV charging infrastructure, ensuring equitable access to clean transportation options such as electric bus fleets and ride sharing or hailing services. Also important is supporting voluntary (e.g., carbon offset) and regulatory (e.g., Transportation Climate Initiative) markets for cleaner transportation that transitions us away from fossil fuel to renewable energy. More specifically, to meet the 2030 target, 20% of the passenger fleet and 30% of the heavy-duty fleet must be zero emission; and to meet the 2050 target, 95% of the passenger fleet and 80% of the heavy-duty fleet must be zero emission.
- **Decarbonizing Buildings** – representing over 30% of Connecticut's economy-wide GHG emissions, residential, commercial, and industrial buildings are the second largest emitting sector that must transition away from fossil fuels to renewable thermal technology. Strategies for zero-carbon buildings include financing and incentives for energy efficiency (e.g., thermal insulation, appliances, etc.) and renewable heating and

[46] "Building a Low Carbon Future for Connecticut – Achieving a 45% GHG Reduction by 2030" recommendations from the Governor's Council on Climate Change (December 18, 2018)

cooling (e.g., air source heat pumps, ground source heat pumps, heat pump water heaters, etc.). To meet the economy-wide 2030 and 2050 targets for Buildings, renewable heating and cooling technologies must be significantly deployed to 11% and 26% for residential, and 9% and 20% for commercial, by 2030 and 2050 respectively.

Figure 4. Example of Key GHG Emission Reduction Measures (i.e., Mitigation Wedges) for Connecticut to Achieve Targets



The size of investment required and long-term revenue streams from clean energy, lend themselves well to bond structures. Issuing green bonds can provide the Green Bank a lower-cost, longer-term source of capital, enabling the Green Bank to further leverage state and federal funds to increase its impact in Connecticut by attracting and mobilizing private investment in the state's green economy. The Green Bank has an important role to play in advancing green bonds in the U.S., especially given its history of engaging citizens and communities and its expertise in developing impact methodologies and a thorough and transparent reporting framework.

7. Citizen Engagement

The Green Bank, and its predecessor the Connecticut Clean Energy Fund (CCEF), have a long-standing history of citizen engagement within the communities of Connecticut. In 2002, the CCEF partnered with six private foundations[47] 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.[48] 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

[47] Emily Hall Tremaine Foundation, The John Merck Fund, Pew Charitable Trust, The Oak Foundation, Rockefeller Brothers Fund, and Surdna Foundation

[48] "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).

Business and the Environment,[49] while also advancing the SunShot Initiative of the U.S. Department of Energy (DOE) 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 low-to-moderate income households.

Engaging citizens has been in the DNA of the Green Bank since its inception.

7.1 Green Bonds US® Campaign

From the air we breathe to the products we consume; the world's population is inescapably connected. And while that may present challenges in the context of global climate change, it also affords incredible opportunities for collaboration and progress.

Whether through markets or within communities, the Connecticut Green Bank is bringing people together and strengthening the bonds we share with one another. As its name suggests, the "Green Bonds US" campaign, seeks to promote a simple but critically important message; green brings us together, green bonds us. The multimedia, brand awareness and green-bond promotional campaign will promote the benefits of green energy, as well as a brand-new green energy investment opportunity provided by the Green Bank.

Mini Bonds

Despite the rising demand for green energy in the state, barriers still exist that may prevent more people from participating in Connecticut's growing green economy. For example, a homeowner who, despite having a strong desire to "go solar", is not able to because of factors like price, siting, or other issues. To allow more people to benefit from, and invest in, green energy, the Green Bank is offering another way. For the first time in its history, the Green Bank will issue "mini" green-bonds (e.g., small denomination bonds, certificate of deposits, and/or other fixed income investments) for sale to institutions and retail investors (i.e., SMAs and individuals). Launching as a pilot program, the mini-bonds represent another step forward on the path to inclusive prosperity.

Market Research

To gauge the public's interest and assess market demand for mini-green-bonds, the Green Bank performed primary and secondary research such as an online survey, interviews with industry professionals, as well as internal review of recent market data and investment reports.

In June of 2019, the Green Bank engaged GreatBlue Research to conduct primary research throughout Connecticut, measuring the market potential for "mini-bonds". A digital survey was sent to two target audiences: 1.) households that have installed solar PV through the RSIP and 2.) the general population (i.e., households that haven't participated in a Green Bank program). When asked "what types of green projects would you support through your private investments," the survey participants had the following responses:

- Recycling and waste reduction – 69.5%

[49] "Solarize Your Community: An Evidence-Based Guide for Accelerating the Adoption of Residential Solar" by the Yale Center for Business and the Environment.

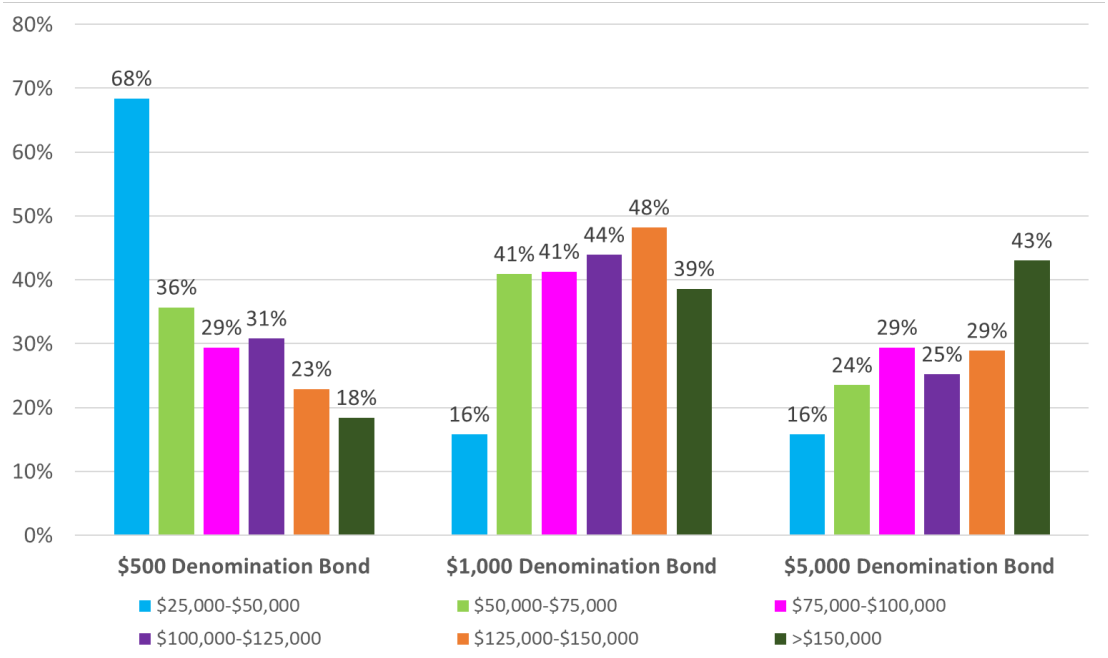
- Clean water – 67.3%
- Roof-top solar – 64.5%
- High efficiency heating and cooling systems – 58.8%
- Home energy efficiency projects – 56.7%
- Land conservation – 49.3%
- Energy efficiency appliance rebates – 45.6%
- Electric vehicles – 41.2%

The Green Bank and GreatBlue research also highlighted that the income of the investor, alongside the denomination of the bond, represents an opportunity for increasing equitable access to greater investment in the environment – see Figure 5.

After taking into account the results of our state-wide primary research, current national trends and conversations with various industry experts, there is sufficient data to suggest that the green bond market for individual investors in Connecticut may be quite large. As a result, the Green Bank intends to issue mini-green-bonds, with proceeds going to support the development of green energy projects within Connecticut.

For more information on the Green Bonds US campaign, visit www.greenbondsus.com

Figure 5. Comparison of Interest in Bond Denomination Value by Income of Survey Respondents



7.2 Sustainable CT

Sustainable CT and the Green Bank are developing an engagement and investment platform to raise capital in support of local projects that provide individuals, families, and businesses with investment opportunities to make an impact on sustainability in their communities. The

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.

Through a partnership between Sustainable CT, IOBY (In Our Backyard), and/or Patronicity, an online crowdfunding platform will enable citizen leaders to have access to financial resources that they need for local sustainability projects.

For more information on Sustainable CT, visit www.sustainablect.com

8. Evaluation Framework and Impact Methodologies

The Green Bank's evaluation efforts seek to understand how the increase in investment and deployment of clean energy 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 clean energy investment.[50] 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.

[50] https://ctgreenbank.com/wp-content/uploads/2017/02/CTGreenBank-Evaluation-Framework-July-2016.pdf

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.

8.2 Green Bond Framework

The Green Bank's Green Bond Framework ("Framework") [51] provides a structure in which the Green Bank can more efficiently and effectively support its efforts to raise capital and deploy more clean energy 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 to meet the 10x goals identified by the United Nations as the level needed to hold off the worst effects of climate change, 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 projects and providing a way for all residents, businesses, and institutions of Connecticut to invest in growing our green economy.

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.

8.3 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 Navigant Consulting, 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.[52]
- **Tax Revenues** – working in consultation with the Connecticut Department of Revenue Services ("DRS"), through the work of Navigant Consulting, 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.[53]
- **Environmental Protection** – working in consultation with the United States Environmental Protection Agency ("EPA") and DEEP, the Green Bank devised a methodology that takes the reduction in consumption of energy 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.[54]

[51] https://ctgreenbank.com/wp-content/uploads/2020/04/CGB_Green-Bond-Framework_final-4-22-2020.pdf
[52] https://www.ctgreenbank.com/wp-content/uploads/2018/03/CGB_DECD_Jobs-Study_Fact-Sheet.pdf
[53] https://www.ctgreenbank.com/wp-content/uploads/2018/09/CGB-Eval-Tax-Methodology-7-24-18.pdf
[54] https://www.ctgreenbank.com/wp-content/uploads/2018/01/CGB-Eval-IMPACT-091917-Bv2.pdf

- **Public Health Improvement** – working in consultation with the EPA, 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.[55]

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.[56] In FY 2020 and FY 2021, the Green Bank is developing its Equity and Energy Burden impact methodologies to accompany its Economy and Environmental methodologies.

The Green Bank's efforts to increase investment in and deployment of clean energy projects – which result in increased benefits to Connecticut and all of society – can also be looked at through the lens of the United Nation's Sustainable Development Goals ("UNSDG's").[57] The UNSDG's include, but are not limited to – reducing poverty, improving health and well-being, making clean energy affordable, increasing economic development, reducing inequalities, supporting sustainable communities, and confronting climate change – areas where the Green Bank is measuring (or will measure) the impacts of its investments.

9. Reporting and Transparency

The Green Bank has extensive reporting on its financial management and societal impact through various mechanisms. As an administrator of ratepayer (i.e., Clean Energy Fund) and taxpayer (e.g., Regional Greenhouse Gas Initiative) resources, the Green Bank believes that complete transparency is important to ensure the public's continued trust in serving its purpose.

9.1 Comprehensive Annual Financial Report (CAFR)

A Comprehensive Annual Financial Report ("CAFR") 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 a CAFR in its annually updated publication *Codification of Governmental Accounting and Financial Reporting Standards*. A CAFR 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 CAFR 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.[58]

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[55] https://www.ctgreenbank.com/wp-content/uploads/2018/03/CGB-Eval-PUBLICHEALTH-1-25-18-new.pdf

[56] http://www.ctgreenbank.com/strategy-impact/impact/

[57] https://www.un.org/sustainabledevelopment/sustainable-development-goals/

[58] 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.

To date, the Green Bank has issued six CAFR'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

As the "gold standard" in government reporting, the CAFR is the mechanism the Green Bank uses to report its fiscal year financial and investment performance – including societal benefits and impacts – to its stakeholders. For each of its six years filing the CAFR with the Government Finance Officers Association the Green Bank has received a Certificate of Achievement for Excellence in Financial Reporting.[59]

9.2 Annual Report

Beyond the CAFR, 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 eight 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

9.3 Auditors of Public Account

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 Connecticut Green Bank in fulfillment of its duties under Sections 1-122 and Section 2-90 of the Connecticut General Statutes.

GFOA established the Certificate of Achievement for Excellent in Financial Reporting Program (CAFR Program) in 1945 to encourage and assist state and local governments to go beyond the minimum requirements of generally accepted accounting principles to prepare comprehensive annual financial reports that evidence the spirit of transparency and full disclosure and then to recognize individual governments that succeed in achieving that goal.

[59] GAO has yet to designate the FY 2019 CAFR with a Certificate of Achievement

To date, the APA has conducted three audits, including:

- Fiscal Years 2012 and 2013
- Fiscal Years 2014 and 2015
- Fiscal Years 2016 and 2017

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 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.[60] In June of 2020, the Comptroller launched Open Quasi, which provides payroll and checkbook level data for all quasi-public organizations in Connecticut.

9.5 Stakeholder Communications

The Green Bank holds quarterly stakeholder webinars to update the general public on the progress it is making with respect to its Comprehensive Plan and annual targets.[61] Through these webinars, the Green Bank staff invite questions from the audience. These webinars are announced through the Green Bank's list serve consisting of thousands of stakeholders as well as the events page of its website.[62]

The Green Bank also issues an e-newsletter through its list serve that provides key topics in the news and important information on products, programs and services.[63]

10. Research and Product Development

As the Green Bank implements its Comprehensive Plan, there will be ongoing efforts to develop new 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 impact, including, for example:

- **Shared Clean Energy Facilities** – to support decarbonizing the electricity infrastructure climate change wedge, while reducing the burden of energy costs on Connecticut's families and businesses, the Green Bank will seek to apply its experience administering the RSIP to supporting and investing in shared clean energy facilities (or community solar projects) with a focus on low-to-moderate income families;

[60] https://openquasi.ct.gov/
[61] https://www.ctgreenbank.com/news-events/webinars/
[62] https://www.ctgreenbank.com/news-events/events-calendar/
[63] https://www.ctgreenbank.com/newsletters/

- **Energy Burden from Transportation** – as Operation Fuel has done an exceptional job quantifying the energy burden for electricity use and heating of homes, understanding the energy burden from transportation (i.e., gasoline to alternative fuel vehicles) will help the Green Bank and others (e.g., Department of Housing, Connecticut Housing and Finance Authority, Partnership for Strong Communities, DEEP, etc.) understand its role in addressing the decarbonization of transportation emissions climate change wedge; and
- Environmental Infrastructure – if there were an expansion of scope for the Green Bank beyond "clean energy," the Green Bank could apply the green bank model to mobilize private investment in "environmental infrastructure".[64] Working with DEEP and other state agencies, local governments, nonprofit organizations, academic institutions, and businesses, the Green Bank could, for example, identify new areas for increased investment in climate change adaptation and resiliency through the issuance of green bonds.[65]

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 2020 Budget

For the details on the FY 2020 budget– click here, and FY 2020 revised budget – click here.

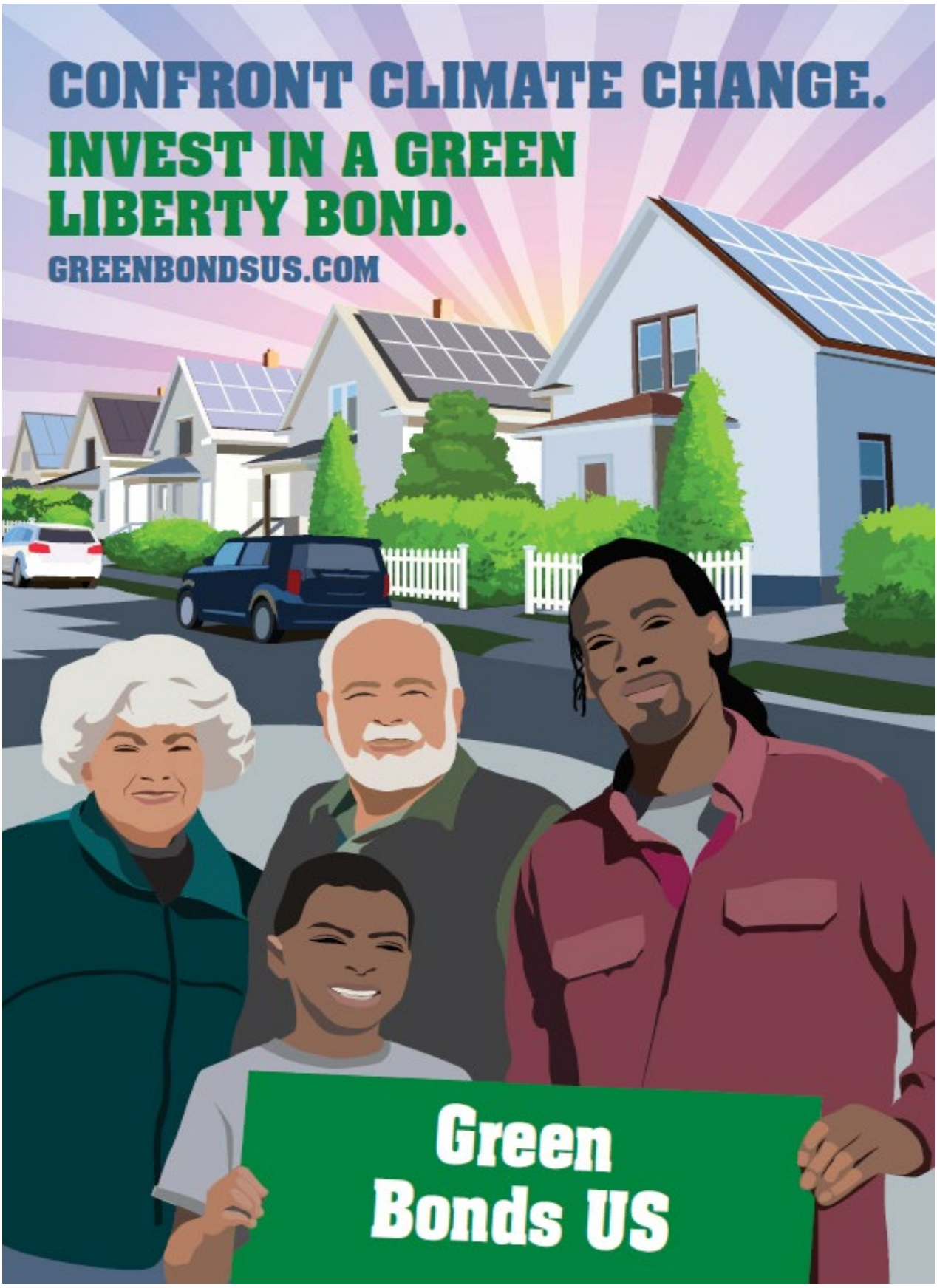
For details on the FY 2019 to FY 2020 variance analysis supporting the continuation of the Sustainability Plan – click here.

11.2 FY 2021 Budget

For the details on the FY 2021 budget– click here.

[64] Proposed Senate Bill 927 in the 2019 Legislative Session

[65] Section 10.3 Sustainability of the Comprehensive Plan of the Connecticut Green Bank for FY 2017 through FY 2019 recognizes that other green banks invest beyond "clean energy" and include "environmental infrastructure".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