energize CONNECTICUT

[bw] RESEARCH PARTNERSHIP

Appendix D & E: Connecticut Clean Energy Innovation

2024

Click the page number to return to the Table of Contents throughout this report.

These appendices are the product of a supplemental analysis conducted by BW Research as part of the 2024 Clean Energy Industry Report (CEIR).

While this is a first for the Connecticut report, BW Research has completed similar data collection and analysis for various states. The data presented here was drawn from federal datasets for Small Business Innovation Research (SBIR), Small Business Technology Transfer (STTR), ARPA-E, Office of Science, and SunShot, the Crunchbase investments database, and other Connecticut resources. These innovation investments are categorized into the major clean energy technologies included in the 2024 CEIR to examine investment trends and gaps. In Appendix E, BW Research has pulled patent data related to clean energy through the U.S. Patent and Trademark Office (USPTO) using their custom definition and USPTO's native coding schema for other states.

Innovation is an important indicator of growth and development. Clean energy innovation in Connecticut is strong and driven by the state's innovation assets.

This section provides an overview of the state's key assets and significant investments within Connecticut's clean energy industry, as well as clean energy patent and investment trends between 2018 and 2023 that highlight the state's innovative environment.

Key Findings

There has been over $153 million in innovation funding between 2018 and 2023 across 99 deals in Connecticut's clean energy economy and significant momentum in Connecticut's clean energy innovation ecosystem.[1] Connecticut is a notable hub for innovation, attracting immense investment to support clean energy research and development in pursuit of climate action. With the nation's first green bank mobilizing green economy investments into the state, a goal to achieve zero-carbon electricity by 2040, and extensive manufacturing capabilities, the state is well positioned as a leader in clean energy innovation and entrepreneurship.

Clean energy innovation funding has grown by 34.7 percent from 2018 to 2023, starting at an average of $21.8 million between 2018 and 2020 and reaching an average of $29.4 million between 2021 and 2023. The number of deals across three-year periods from 2018 to 2023 has remained relatively constant, averaging 15 to 18 deals and indicating an increase in the overall funding amount invested in each deal.

Investments to support clean energy innovation in Connecticut are largely Alternative Transportation and Energy Efficiency ventures. Between 2018 and 2020, clean energy innovation funding in Connecticut, on average, was concentrated in Clean Energy Generation and Clean Fuels. However, from 2019 to 2023, investments over three-year rolling averages shifted to innovation in Alternative Transportation.

Phase I innovation investment[2] **has seen huge growth between 2018 and 2023, based on three-year averages, while phase II funding**[3] **was declining until recent growth.** Since 2018, momentum in early research and development in Connecticut's clean energy economy can be highlighted by increasing phase I investment, from an average of $1.1 million from 2018 to 2020 and reaching $14.0 million overall between 2021 and 2023. Large research universities in the state, including the University of Connecticut and Yale University, are home to several recent initiatives that support research and innovation in climate-related and clean energy fields, such as considerable investment and the establishment of new programs and partnerships, laboratories, and research and training centers. At the same time, phase II investments declined from $13.8 million during the 2018 to 2020 rolling average to $4.7 million during the 2020 to 2022 rolling average and $7.2 million from 2021 to 2023.[4] As phase I funding grows, more startups and researchers may seek support to begin testing and refining their designs and prototypes.

[1] This does not include nine investments in four unique companies totaling almost $2.4 billion during this period. These investments have been identified as outliers and excluded from the broader analysis of clean energy investment trends in Connecticut.

The clean energy innovation funds analyzed in this report are included and categorized according to the state's definition of clean energy. For further detail on Connecticut's clean energy industry definition, please refer to Appendix B: Clean Energy Technology List and Definitions of the CT Green Bank's 2024 Connecticut Clean Energy Industry Report. Funding in clean energy technologies not included in the definition are not captured here.

Please see Appendix E: Clean Energy Patent and Investment Methodology for more detail on the clean energy patent and investment data sources.

[2] Phase I of innovation involves basic research and ideation.

[3] Phase II of innovation involves technology testing, demonstration, and refinement.

[4] 15 funding deals totaling $15.7 million could not be categorized as Phase I, II, or III deals due to lack of information.

Between 2018 and 2023, there were seven phase III investments[5] in clean energy innovation in Connecticut totaling $29.3 million and nine phase III outliers totaling $2.4 billion. Including these outliers, from 2018 to 2020, there was an average of $307.8 million in phase III clean energy innovation funding, rising to $488.5 million, on average, between 2021 and 2023. Between the state's steadfast commitment to promoting clean energy through various state-led incentives and numerous research and development resources, some Connecticut-based companies are receiving significant late-stage funding to scale up innovative solutions in the clean energy space. Yet, while the phase III funding amounts tend to be larger due to high commercialization costs, these types of deals are occurring much less frequently than earlier phase investments in Connecticut.

While there has been a greater number of publicly funded investment deals compared to privately funded deals, private investment deals have a large impact on clean energy innovation in Connecticut, especially in the late phase of innovation. When excluding the nine late-stage and outlying investments deals, most ($112.4 million) total investment in clean energy innovation in Connecticut since 2018 comes from public sources across 83 deals. Conversely, with the large, outlying investment deals from private sources in more costly, late-stage innovation, this ratio shifts such that private deals account for almost all ($2.4 billion) of the state's innovation funding between 2018 and 2023.[6] Private entities also receive almost all (91.9 percent) of the total investment. Of the 40 unique grantees, 39 are private entities and one is a public entity, the University of Connecticut.

While total patents granted in Connecticut continuously declined between 2019 and 2023, the number of clean energy patents granted in the state started to grow toward the end of the period. From 2022 to 2023, Connecticut's clean energy patents grew by 29.6 percent, or 34 patents, while its overall patents experienced a marginal drop of 3.8 percent after repeated year-over-year decline since 2019. By 2023, clean energy patents represented a larger share of total patents in Connecticut (6.4 percent) than they did in 2019 (4.7 percent) and present an opportunity for further investment to stimulate innovation and accelerate the commercialization of new clean energy technologies in the state.

Over one-third (35.3 percent) of all clean energy patents granted in Connecticut since 2019 are related to the Clean Grid and Storage technology sector. While the Clean Grid and Storage technology sector makes up a small share of total clean energy employment in the state, the largest concentration of clean energy patents granted between 2019 and 2023 are related to this sector. As innovation in this sector continues, it may begin to support a greater clean energy workforce in the near future.

Cumulatively, patents related to Clean Grid and Storage, Alternative Transportation, and Energy Efficiency technologies represent 91.7 percent of total clean energy patents issued between 2019 and 2023. In addition, after annual declines in the number of clean energy patents issued after 2019, possibly due to COVID-19 pandemic impacts, Connecticut recently had an increase in patent issuances in 2023, of which 34.9 percent were Alternative Transportation-related patents.

Connecticut has a long-standing history of innovation assets and activity, as demonstrated by Connecticut Innovations, its venture capital unit founded in 1989, and the University of Connecticut's Center for Clean Energy Engineering, which opened in 2002. Academic institutions including the University of Connecticut and Yale University drive much of the state's clean energy innovation activities through a variety of programs. Patent and investment trends also highlight the role these academic institutions play in supporting clean energy innovation across the state.

[5] Phase III of innovation involves full development and commercialization.

[6] Approximately 14.1 percent ($21.7 million) of investment deals could not be categorized as public or private due to lack of information.

The Innovation Landscape in Connecticut

Connecticut has established itself as a leader in developing innovative clean energy technologies, driven by cutting-edge research and new advancements from the state's collection of universities, research institutions, and private firms. Recent clean energy innovation in the state includes significant advancements in solar fuel technologies, demonstrated by researchers at Yale University who are developing new photoelectrodes that convert carbon dioxide (CO_2) into methanol (an alternative liquid fuel) 17 times more efficiently than previous technologies.[7]

The state has also made advancements in wind generation, energy delivery, and carbon capture technologies, with researchers at the University of Connecticut's Eversource Energy Center developing novel grid resilience and load management algorithms to optimize the projected increases in wind generation.[8]

Danbury-based FuelCell Energy, Inc. (FCE) has also developed a carbonate fuel cell platform in collaboration with ExxonMobil that can capture over 90 percent of CO_2 from industrial exhausts while generating electricity and hydrogen, thus facilitating decarbonization across various industries. In 2024, FCE advanced its ongoing joint development agreement with ExxonMobil Technology and Engineering Company through December 31, 2026, to allow for continued work on the technology, including the support of the pilot project at the Esso Nederland BV Rotterdam Manufacturing Complex.[9] FCE also established a fully operational CO_2 recovery demonstration plant at its Torrington production facility, as part of its Carbon Recovery project.[10]

The Innovation Partnership Building opened in September 2018.

Other prominent clean energy innovations include the creation of a novel insulation material that improves heat dissipation and operational efficiency of electric motors[11], as well as the development of new quantum encryption tools to improve microgrid resilience against potential cyberattacks.[12] Both innovative technologies were spearheaded by University of Connecticut researchers.

A FuelCell power plant in Bridgeport, Conn., with the Danbury-based company manufacturing fuel cell components in Torrington. (File press photo via FuelCell Energy).

[7] https://news.yale.edu/2024/05/17/sun-sustainability-and-silicon-double-dose-yale-solar-fuel-research

[8] https://sustainable-power-energy.research.uconn.edu/2024/07/21/prof-zongjie-wang-awarded-4-5m-doe-grant-to-benefit-grid-reliability-for-transmission-and-distribution-systems-2/

[9] https://investor.fce.com/press-releases/press-release-details/2023/ExxonMobil-to-Build-CCS-Pilot-Plant-with-FuelCell-EnergyUsing-Carbonate-Fuel-Cell-Technology/default.aspx

[10] https://www.fuelcellenergy.com/blog/co2-recovery-with-fuel-cell-technology

[11] University of Connecticut Technology Commercialization Services. Press Release: New Patent Issued, February 2023. https://innovation.uconn.edu/2023/02/02/new-patent-issued/

[12] System and Method for Quantum-Secure Microgrids. Patent number 20250007700. More information can be found on the U.S. Patent and Trademark Office website, https://www.uspto.gov/patents/search/patent-public-search, or the National Library of Medicine, https://pubchem.ncbi.nlm.nih.gov/patent/US-2025007700-A1.

The state benefits from an established network of incubators, accelerators, and other related resources to catalyze and support advancements in clean energy technologies, such as Connecticut Innovations (CI), the state's quasi-public venture capital provider.[13] One of CI's flagship initiatives is the $100 million Climate Tech Fund, which supports startups and growth-stage companies focused on sustainability and climate-related innovation.[14] The fund provides strategic investments to accelerate the development and commercialization of numerous clean energy, mobility, carbon capture, and other climate technologies.

CI's venture portfolio includes numerous clean energy and climate-focused companies, such as Nimbus, Oxylus Energy, Crew, Budderfly, AMPUP, and Zoneflow.[15] These companies develop innovative climate solutions ranging from carbon capture, energy efficiency, and electrification to AI-driven grid optimization, and CI's investments enable these companies to scale their impact and advance market deployment efforts. In addition to these established investments, CI continues to expand its venture portfolio: in the first quarter of 2025 alone, CI made approximately $8 million in climate tech investments.[16] By fostering entrepreneurship and technological advancement, CI aims to create jobs and position Connecticut as a destination hub for climate innovation.

ClimateHaven is a nonprofit climate technology incubator based in New Haven, Connecticut, dedicated to accelerating the development of breakthrough solutions in energy and climate resilience.[17] ClimateHaven fosters a collaborative environment where entrepreneurs can scale innovations by leveraging ClimateHaven's suite of tailored support service offerings. These support services include mentorship and advisory networks, strategic partnership advising, and access to prototyping and co-working spaces, such as the Biolabs CT wet lab facility[18] and the MakeHaven fabrication workshop.[19]

The New England Heat Pump Accelerator program, a multi-state effort to accelerate residential heat pump adoption across the New England region, recently received a $450 million grant from the U.S. Environmental Protection Agency (EPA) to invest in the manufacturing and workforce infrastructure needed to lower costs for New England residents. A portion of this funding is allocated to support innovative pilots to deploy heat pumps in hard-to-reach regions of the state and nontraditional residential building types, such as mobile homes and aging multifamily buildings.[20]

Connecticut's universities also play a critical role in driving clean energy innovation. Yale University is home to various clean energy consortia and research initiatives, including the Carbon Containment Lab (CC Lab), Yale Planetary Solutions (YPS), the Yale Center for Natural Carbon Capture (YCNCC), the Yale Center for Green Chemistry and Green Engineering (CGCGE), and the Yale Center for Business and the Environment (CBEY).

CC Lab is a nonprofit recently spun out of Yale University that focuses on developing scalable solutions for emissions of super pollutions and carbon removal.[21] The lab combines scientific research, entrepreneurship, and investment strategies to identify practical methods for reducing atmospheric greenhouse gases. By working with experts across disciplines, CC Lab pioneers innovative approaches to long-term carbon sequestration and emissions abatement, ensuring that solutions are both effective and economically viable. The lab also engages with policymakers and industry leaders to accelerate the adoption of carbon reduction technologies.

YPS is a university-wide initiative established in 2020 that leverages Yale's academic and operational resources to drive climate action and environmental sustainability.[22] The program fosters interdisciplinary collaboration among researchers, policymakers, and business leaders to develop real-world solutions for climate challenges. Areas of focus include clean energy, biodiversity conservation, sustainable agriculture, and climate adaptation strategies.

[13] Connecticut Innovations, Accessed April 2025. https://ctinnovations.com/

[14] Connecticut Innovations ClimateTech Fund, Accessed April 2025. https://ctinnovations.com/program/climate-tech-fund/

[15] A full list of companies in CI's venture portfolio is available at: https://ctinnovations.com/investors/venture-portfolio/

[16] Connecticut Innovations Financial Snapshot, Accessed April 2025. https://ctinnovations.com/learn-about-connecticut-innovations/financial-snapshot/

[17] https://www.climatehaven.tech/about

[18] https://www.biolabs.io/new-haven

[19] https://www.makehaven.org/

[20] https://portal.ct.gov/deep/energy/new-england-heat-pump-accelerator

[21] https://carboncontainmentlab.org/

[22] https://planetarysolutions.yale.edu/

A key initiative spurred by YPS is the Yale Center for Natural Carbon Capture (YCNCC).[23] Established in 2021, YCNCC performs critical research on accelerating and optimizing natural carbon sequestration solutions, including research on marine carbon dioxide removal and green ammonia generation technologies. YCNCC leverages its connections with a wide range of public and private entities to advance its research initiatives, including funding and partnership agreements with the U.S. Department of Energy, the National Science Foundation, Microsoft, and FedEx.[24]

The Yale Center for Green Chemistry and Green Engineering (CGCGE) is a longstanding research consortium dedicated to developing safer, more sustainable chemical solutions that reduce environmental impact.[25] Founded in 2007 as a cross-cutting subsidiary of the Yale School of Environment, the School of Arts and Sciences, and the School of Engineering and Applied Sciences, the consortium leverages its interdisciplinary foundations to conduct novel research on eco-friendly materials, renewable chemical processes, and pollution prevention strategies. By promoting green chemistry principles, CGCGE helps industries transition to sustainable manufacturing and cleaner production methods. It also pursues education, outreach, and awareness initiatives to train the next generation of scientists and engineers in sustainable chemical innovations.

The Yale Center for Business and the Environment (CBEY), founded in 2006, is another notable university resource that provides seed grants to emerging clean energy firms through its Climate Innovation Grant program.[26] In its 2024 award cycle, CBEY awarded $15,000 in grants to seven clean energy and environment-focused ventures.[27]

The University of Connecticut also houses several innovation-related resources. These include the Center for Clean Energy Engineering (C2E2), Connecticut Power Electronics Center of Excellence (CONPEX), and the U.S. Department of Energy-funded Southern New England Industrial Training and Assessment Center (SNE-ITAC) and Onsite Energy Technical Analysis and Support Center (TASC).

C2E2, established in 2002 as the Connecticut Global Fuel Cell Center, is one of the state's longstanding clean energy research consortia.[28] Initially focused on driving innovations in fuel cell research, the center was renamed C2E2 in 2009 to reflect its widened breadth of focus across the clean energy ecosystem. It is home to 47 multidisciplinary resident and affiliate faculty researchers, who leverage its prototyping and testing laboratories to facilitate clean energy technology research, often in collaboration with private industry leaders. C2E2 also supports research in related fields such as composites, materials manufacturing, and water filtration. In FY22, the center received over $46.6 million in proposal funding.[29]

C2E2 new solid oxide fuel cell units provide high efficiency power from a variety of sources.

CONPEX, established in late 2024, focuses on developing institutional research projects, collaborative opportunities, and educational programs across a variety of clean energy technologies, including transportation electrification, smart grid, and offshore wind, among others.[30] Participation at CONPEX is open to both private industry and University of Connecticut faculty.

[23] https://naturalcarboncapture.yale.edu/

[24] Yale Center for Natural Carbon Capture (YCNCC). 2024 Annual Report. https://naturalcarboncapture.yale.edu/sites/default/files/files/YALE%202024%20YNCC%20AnnualReport%20Public.pdf

[25] https://greenchemistry.yale.edu/

[26] https://cbey.yale.edu/

[27] https://cbey.yale.edu/our-stories/seven-teams-awarded-cbeys-2024-climate-innovation-grants

[28] https://www.energy.uconn.edu/

[29] C2E2. 2022 Annual Report. https://www.energy.uconn.edu/annual-report/

[30] https://powerelectronics.engineering.uconn.edu/

SNE-ITAC, established in the fall of 2021, was commissioned to provide energy assessments to small and medium-sized manufacturers in the New England states and areas of Long Island and New York City, as well as to provide hands-on training to engineering students to prepare them for future careers in energy and power fields. Since its inception, the center has conducted over 50 energy assessments in manufacturing facilities of various industries, 35 of which are in Connecticut. In collaboration with Eversource, Avangrid, and other community partners, the cost and energy savings from the implementation of the energy conservation measures identified in these assessment projects have accumulated to approximately $1.6 million and 40,000 MMBtu.[31]

A joint venture between the U.S. Department of Energy's Industrial Efficiency and Decarbonization Office, the University of Connecticut, and a host of private industry firms,[32] TASC serves as the lead institution for the Department of Energy's national network of eight regional organizations, known as Technical Assistance Partnerships (TAPs). These TAPs aim to help industrial facilities and other large energy users increase the adoption of "onsite energy technologies," which encompasses a broad range of technologies, including battery storage, combined heat and power (CHP), district energy, fuel cells, geothermal, industrial heat pumps, renewable fuels, and solar photovoltaics, among others. Through a competitive bid process, the University of Connecticut was selected to lead this initiative in 2023 and support the regional organizations in conducting clean energy technology feasibility and implementation analyses for various firms and their associated industrial facilities.[33]

Overall, Connecticut has succeeded in creating a strong environment that fosters innovation and supports the development of a breadth of innovative ideas, research, and technologies that help drive its clean energy initiatives. Connecticut Governor Ned Lamont recognized the successes of Connecticut's innovative clean energy research in his 2025 State of the State Address by citing Budderfly, a CI-funded startup that deploys energy efficiency technologies across residential and industrial buildings in the state.[34]

[31] https://iac.uconn.edu/

[32] Including DNV Energy Insights USA Inc., Analytical Energy Solutions, eSai LLC, Impact Energy, and RE Tech Advisors, LLC

[33] https://www.energy.gov/eere/iedo/articles/funding-selections-onsite-energy-technical-assistance-partnerships

[34] https://portal.ct.gov/governor/news/speeches/governor-lamont-2025-state-of-the-state-address?language=en_US

Patents

Patent trends offer valuable insights into a region's innovation and business development environment. This section examines the number and types of clean energy-related patents filed in Connecticut from 2019 to 2023, sourced from the U.S. Patent and Trademark Office. The clean energy patents analyzed in this report, granted to individuals, projects, or groups, are categorized according to the state's definition of clean energy,[35] providing an overview of how new clean energy technology development has progressed.

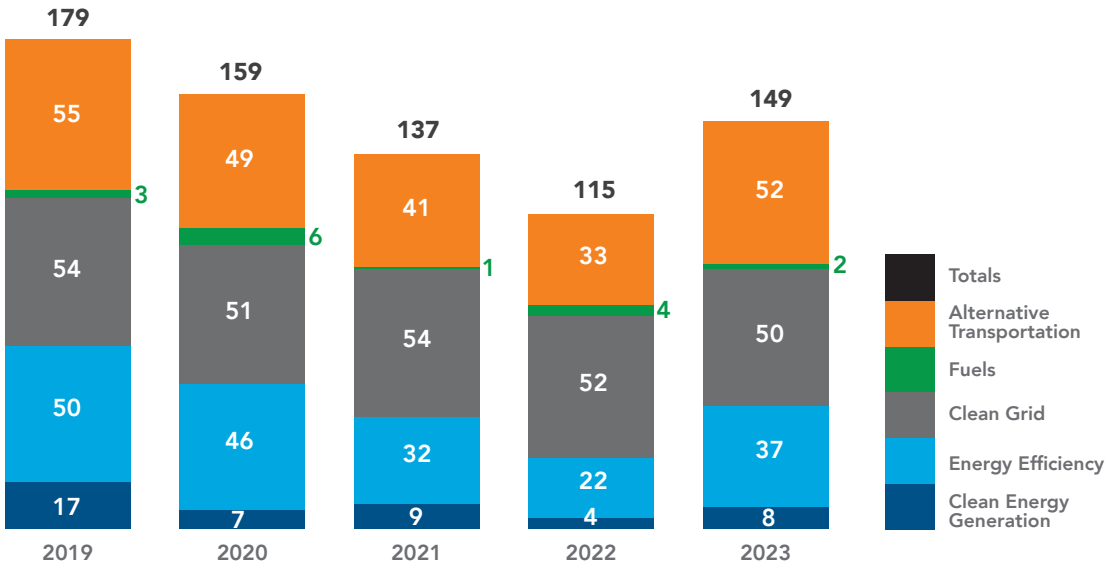
Since 2019, more than 700 clean energy-related patents have been granted in Connecticut, representing 5.0 percent of total patents granted to assignees in the state. The number of clean energy patents granted has slowed year after year from 2019 to 2022 but experienced the first increase from 2022 to 2023 since 2019.

Between 2022 and 2023, the number of patents grew by 29.6 percent, or 34 patents (Figure 20). Across Connecticut's broader economy, the number of total patents granted to Connecticut declined by 3.8 percent. Clean energy patents represented 4.7 percent of total patents granted in Connecticut in 2019, increasing to 6.4 percent in 2023.[36]

Over one-third (35.3 percent) of clean energy patents granted in Connecticut since 2019 are related to the Clean Grid technology sector, in which 261 patents were granted. Another one-third (31.1 percent) are related to the Alternative Transportation sector, totaling 230 relevant patents from 2019 to 2023, while Energy Efficiency-related patents represent one-quarter (25.3 percent) of all clean energy patents granted during this period. Far fewer patents within the Clean Energy Generation and Fuels technology sectors were granted, collectively representing 8.3 percent of all clean energy patents (Figure 1).

Clean Energy Patents By Technology Sector, 2019-2023[37]

Figure 1



[35] For further detail on Connecticut's clean energy industry definition, please refer to Appendix B: Clean Energy Technology List and Definitions of the 2024 Connecticut Clean Energy Industry Report.

[36] Total patents are sourced from the U.S. Patent and Trademark Office, 2019-2023, https://patentsview.org/datatool#search

[37] U.S. Patent and Trademark Office. PatentsView. Accessed February 2025. https://patentsview.org/home.

Investments

Investments play a key role in assessing the health of the clean energy economy. The investments highlighted in this section include early-stage research and development grants aimed at supporting innovative ideas and emerging pioneers in the clean energy technology sector. Later-stage investments are also examined since they can demonstrate the strength of the commercial market where established clean energy technologies are seen as profitable and promising opportunities. Overall, these investments drive further economic activity and generate diverse jobs.

The investment and expenditure data in this analysis is obtained from a variety of sources, including the SunShot Initiative, Office of Science, and the Advanced Research Projects Agency—Energy (ARPA-E) of the U.S. Department of Energy; the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs sponsored by the U.S. Small Business Administration; and Crunchbase, a proprietary dataset and platform that collects investments and funding information for public and private companies. However, these federal and private sources may not reflect all state investments in clean energy innovation between 2018 and 2023. In addition, any investment deal captured by these sources without a specified funding amount has been excluded from this report's analysis.

The clean energy innovation funds analyzed in this report are categorized according to the state's definition of clean energy.[38]

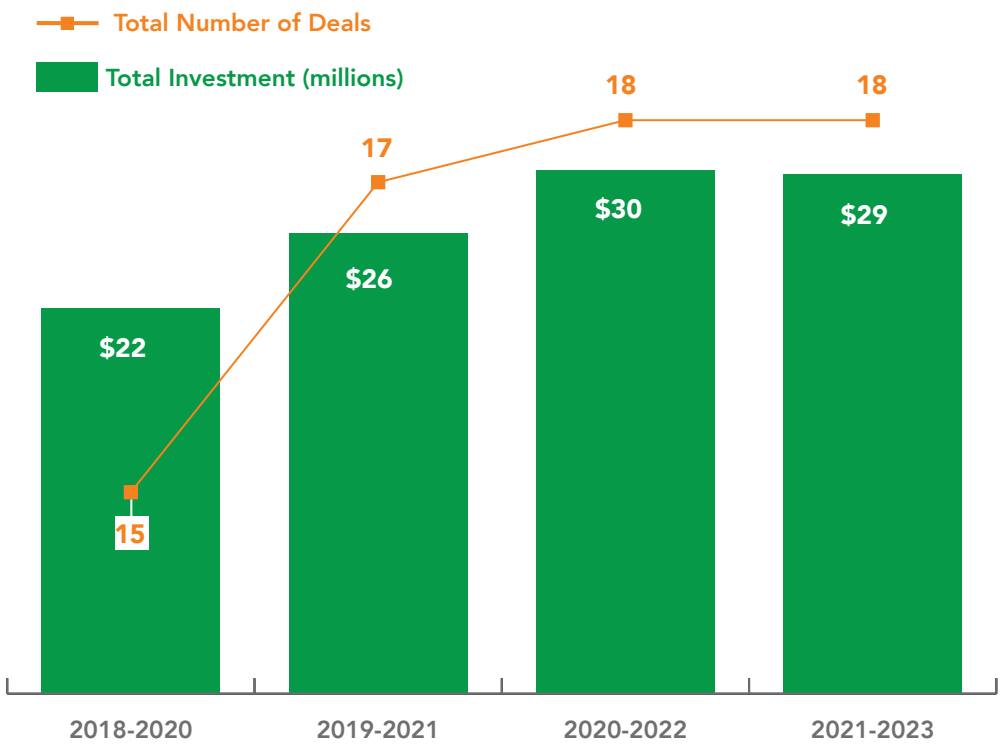
[38] For further detail on Connecticut's clean energy industry definition, please refer to Appendix B: Clean Energy Technology List and Definitions of the 2024 Connecticut Clean Energy Industry Report.

Overall Clean Energy Investments

There has been a total investment of $153.4 million between 2018 and 2023 across 99 funding deals in Connecticut's clean energy innovation economy. Clean energy innovation funding has grown by 34.7 percent from the start of tracking in 2018 to present, starting at a $21.8 million three-year rolling average across 2018 and 2020 and reaching a $29.4 million average across 2021 and 2023.[39] The average number of deals across the three-year periods from 2018 to 2023 has remained relatively constant, averaging 15 to 18 deals a year (Figure 2).

Clean Energy Investments, Three-Year Rolling Average, 2018-2023[40]

Figure 2



In addition to these 99 deals, nine large deals totaling $2.4 billion collectively have also occurred. Four unique private companies are the recipients of these nine outlying deals:

- Budderfly, an energy management company based in Shelton, CT, secured $55 million in debt financing to scale its services in 2019.
- Greenwich-based Counterpointe Sustainable Real Estate secured nearly $256 million in PACE financing in 2023 to support energy efficient technology in kitchens.
- HyAxiom, Inc., a fuel cell and electrolyzer developer and manufacturer headquartered in East Hartford, CT, received $150 million in 2023 to continue commercializing its products and services.
- Altus Power, a clean power company based in Stamford, CT, received a total of $1.9 billion between 2018 and 2023, including $293 million in 2023 to develop 220MW of solar PV assets and $850 million in 2020 to recapitalize the firm.

These large investments are considered outliers when compared to the amounts of the other 99 funding deals and are excluded from the analysis below to better understand yearly investment trends.

Over $300 million in funding for carbon capture and hydrogen generation technology development in Connecticut was also identified but excluded from this analysis since these technologies are not within the state's clean energy definition.[41]

[39] Clean energy investments are reported based on three-year rolling averages to smooth the impacts of a singular large investment in a given year.

[40] Please see Appendix E: Clean Energy Patent and Investment Methodology for more detail on the clean energy investment data sources.

[41] For further detail on Connecticut's clean energy industry definition, please refer to Appendix B: Clean Energy Technology List and Definitions of the 2024 Connecticut Clean Energy Industry Report.

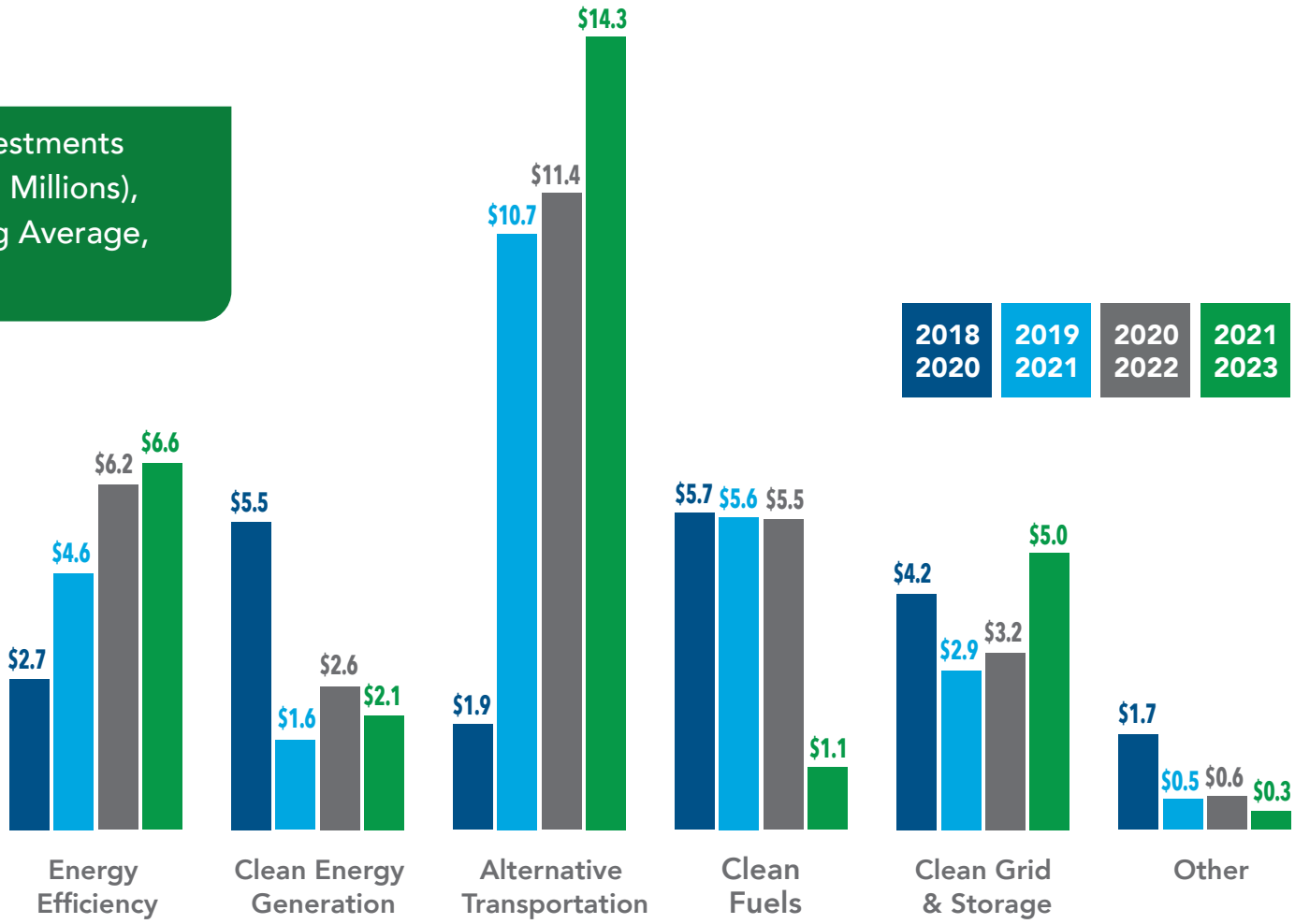
Clean Energy Investments By Technology

Investment in Alternative Transportation accounts for the greatest investment in Connecticut's clean energy innovation economy. Aside from the 2018 to 2020 three-year period, clean energy innovation funding has been concentrated in Alternative Transportation technologies, increasing from an average of $1.9 million between 2018 and 2020 to $14.3 million overall between 2021 and 2023 (Figure 3).

While total investment in clean energy has grown from the 2018 to 2020 to the 2021 to 2023 rolling averages, this is not seen in each major technology sector. The Alternative Transportation and Energy Efficiency sectors have both seen enormous growth in funding, but funding has decreased for both Clean Energy Generation and Clean Fuels, by an average of $3.5 million and $4.6 million, respectively, between these three-year periods (Figure 3).

Clean Energy Investments By Technology (In Millions), Three-Year Rolling Average, 2018-2023[42]

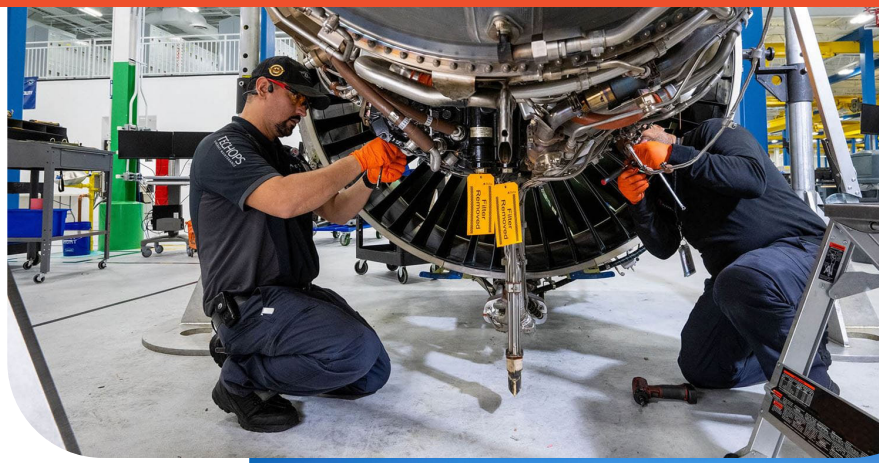
Figure 3



[42] Other investments are those that cannot be classified under or assigned to a single technology sector. Some investments are more general in nature (i.e., innovation competitions, research labs, etc.) and cannot be entirely dedicated or directed towards a specific technology area. Please see Appendix E: Clean Energy Patent and Investment Methodology for more detail on the clean energy investment data sources.

Clean Energy Investments By Source And Recipient

While there have been more public deals than private over each three-year period, private investments can be seen having a greater impact on overall clean energy innovation funding in the state. From 2018 to 2023, 83 public deals amounted to $112.4 million, or 73.3 percent of total investments. In addition, while the amount invested through public deals rose to $20.7 million in the 2021 to 2023 three-year rolling average, the average number of deals has remained consistent over three-year spans since 2018, indicating a rise in the amount of dollars invested in individual deals overall (Figure 4).[43]

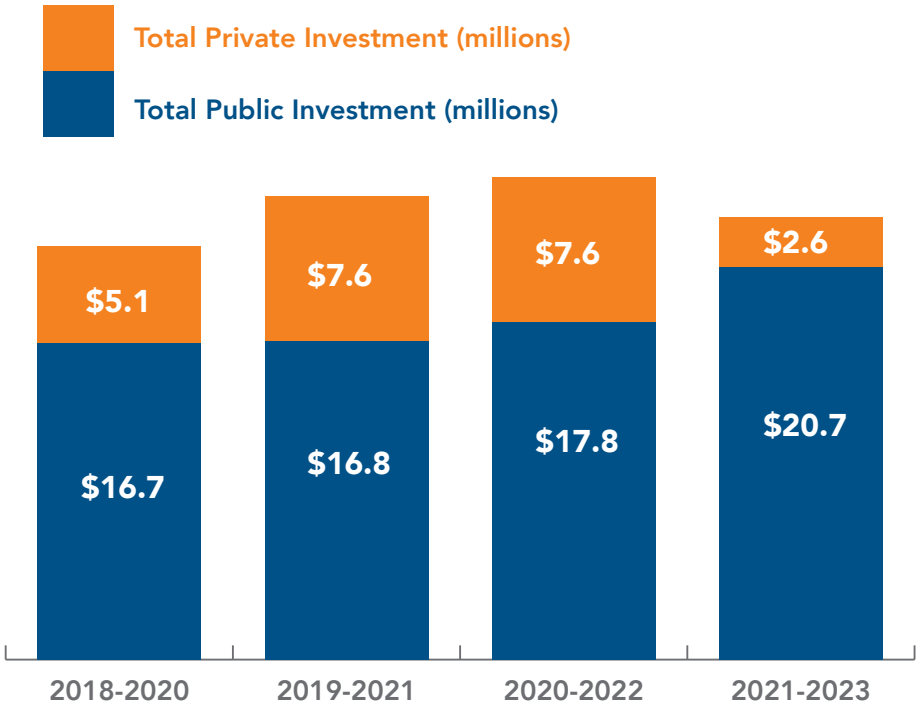


Above, Pratt & Whitney, an RTX (NYSE: RTX) business, and Delta Air Lines expand GTF overhaul capacity.

Raytheon Technologies Research Center, East Hartford, CT.

Clean Energy Investments By Source (In Millions), Three-Year Rolling Average, 2018-2023[44]

Figure 4



Among the 99 investment deals in clean energy innovation in Connecticut between 2018 and 2023, there were only nine private sector investment deals totaling close to $23.0 million.[45] Nine additional private deals were identified as supporting clean energy innovation in Connecticut during this time but are regarded as outliers and excluded from this analysis due to the significant amount of investment in each deal. These outliers total almost $2.4 billion in private investment (Figure 4).

Between 2018 and 2023, 40 unique entities have received clean energy innovation funding. Among the recipients, 39 are private entities, which have received 91.9 percent of the total investments. The remaining entity was the University of Connecticut, having received almost $12.4 million since 2018. Raytheon Technologies Research Center, the East Hartford-based innovation hub of RTX Corporation, is a key private grantee, receiving almost $25.0 million of public funds between 2018 and 2023.

[43] The passage of the Inflation Reduction Act in 2022 contributed to federal funding for clean energy research and development during the 2021-2023 period.

[44] Totals will not sum to Figure 21 because not all investments could be categorized as public or private due to lack of information and some quasi-public investment. Please see Appendix E: Clean Energy Patent and Investment Methodology for more detail on the clean energy investment data sources.

[45] Seven deals totaling $18.0 million could not be categorized as public or private because they came from quasi-public entities or there was a lack of information.

Clean Energy Investments By Innovation Phase

The next section presents a detailed breakdown of investment data across the three stages of innovation funding. It is important to note that 15 investments representing 10.3 percent ($15.7 million) of total innovation investment ($153.4 million) cannot be classified into a specific innovation phase due to insufficient data on or in abstracts, projects, or investment deals. Consequently, the totals for each innovation phase may not add up to the overall totals provided in (Figure 5).

The Innovation Phases

Phase I: Research & Prototyping

This first stage involves basic research and ideation. Funding for these projects typically comes from public sources, although those with private investors often receive larger amounts of funding.

Phase II: Demonstration & Acceleration

This second innovation phase is when technology demonstration and refinement happens. Startups and innovators also start preparing to reach Phase III and begin commercialization processes.

Phase III: Commercialization & Growth

In the final phase of innovation, businesses launch fully developed products for widespread commercial distribution. These investments are often larger funding deals sourced from private entities because commercialization is more costly than initial research and prototype development.

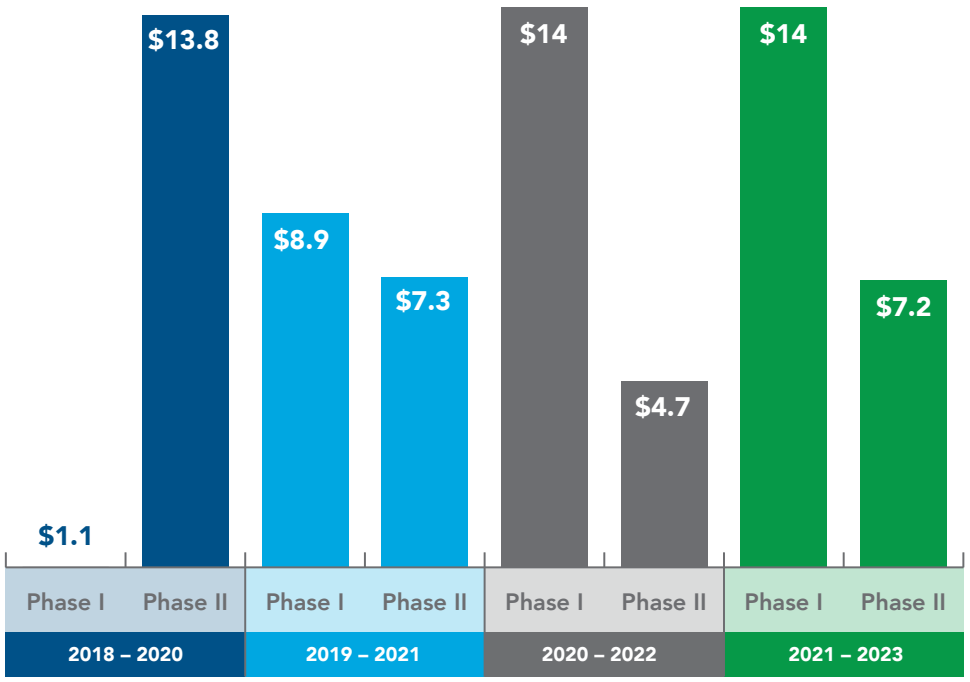
Phase I deals contributed an average of $14.0 million during both three-year spans from 2020 to 2022 and from 2021 to 2023, a significant increase from the $1.1 million of phase I investments during the three-year rolling average between 2018 and 2020. Meanwhile, the average funding amount of phase II deals has fluctuated over this time. After decreasing consistently across the 2018 to 2020, the 2019 to 2021, and the 2020 to 2021 three-year periods, phase II investments rose to $7.2 million during the 2021 to 2023 three-year rolling average (Figure 5).

Phase III innovation investments are less common in Connecticut's clean energy industry than investments in phases II and II. Between 2018 and 2023, there was an average of one to two phase III deals in each three-year period between 2018 and 2023. There was also an average increase in phase III deals, from approximately $6.1 million on average between 2018 and 2020 to $8.3 million between 2019 and 2022. However, during the three-year rolling average of 2021 to 2023, phase III deals dropped to $3.7 million.

Nine outliers were excluded from this analysis; all are phase III innovation investments from private funding sources. These deals totaled $2.4 billion, primarily in Clean Energy Generation. When accounting for these, phase III deals significantly outweigh phase I and II deals.

Connecticut Phase I And II Clean Energy Investments (In Millions), Three-Year Rolling Average, 2018-2023[46]

Figure 5



[46] Please see Appendix E: Clean Energy Patent and Investment Methodology for more detail on the clean energy investment data sources.

Phase III investments are not displayed in this chart given fewer deals to highlight.

The clean energy-related patents analysis is based on the U.S. Patent and Trademark Office's PatentsView tool, accessed in February 2025.

Patents filed in Connecticut from 2019 to 2023 were analyzed and categorized as clean energy if they were related to an energy technology that is classified as a clean energy technology in Connecticut. The state's clean energy definition can be found in Appendix B of the Connecticut Green Bank's 2024 Clean Energy Industry Report.

The clean energy innovation funding analysis is drawn from a variety of sources, including U.S. federal offices and Crunchbase, a proprietary dataset and platform that collects investments and funding information for public and private companies. These sources were accessed in February 2025 and March 2025 and may not reflect all state level investments in clean energy innovation between 2018 and 2023.

At the federal level, clean energy innovation funding announced by the U.S. Department of Energy's SunShot Initiative, Office of Science, and the Advanced Research Projects Agency—Energy (ARPA-E) as well as the U.S. Small Business Administration's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs are included in this analysis. Funding data from these federal sources, along with Crunchbase, were analyzed and categorized as clean energy innovation funding based on Connecticut's definition of clean energy. Any investment deal captured by these sources without a specified funding amount has been excluded from this report's analysis.

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