2023 POLICY GUIDE TO LOCAL ENERGY RESILIENCE FOR CONNECTICUT

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WITH SPECIAL THANKS TO MADISON SCHETTLER AND OUTSIDE REVIEWERS

Table of Contents

CIRCA

MISSION

The mission of the Connecticut Institute for Resilience and Climate Adaptation (CIRCA) is to increase the resilience and sustainability of Connecticut communities vulnerable to the growing impacts of climate change on the natural, built, and human environments.

ABOUT

CIRCA is a multi-disciplinary center of excellence that brings together experts in the natural sciences, engineering, economics, political science, finance, and law to provide practical solutions to problems that result from a changing climate. The Institute helps coastal and inland floodplain communities in Connecticut and throughout the Northeast better adapt to changes in climate. It also works to make the human-built infrastructure of these communities more resilient, while protecting valuable ecosystems and the services they offer to human society (food, energy and clean air and water). The Institute combines the world-class research capabilities of the University of Connecticut (UCONN) and the progressive policies and practical regulatory experience of the Connecticut Department of Energy and Environmental Protection (DEEP) to translate sound scientific research into actions that ensure the resilience and sustainability of both the built and natural environments of the coast and watersheds of Connecticut.

Connecticut and the Northeast are particularly susceptible to the impacts of climate change and associated severe weather events, but the problem exists at the national and international scales as well, with droughts and flooding worldwide. Severe storms in the United States in 2022 caused 474 deaths and around $165.1 billion in property damage.[1] Aside from floods, the costliest and deadliest of natural disasters are droughts, pollution of water resources and coastal areas, ocean currents and severe weather (ice/snow/hailstorms, hurricanes, etc.). Climate change affects the water cycle increasing the frequency of abnormal weather, including heavy rains and droughts, around the world with particularly severe impacts in developing countries. While the Institute's immediate attention is focused on Connecticut and the Northeast, it will also develop comprehensive approaches to climate change research at the national and international scales.

In collaboration with local, regional, and national partners, the Institute's multi-disciplinary research, outreach, and education programs will strive to:

- Improve scientific understanding of the changing climate system and its local and regional impacts on coastal and inland floodplain communities;
- Develop and deploy natural science, engineering, legal, financial, and policy best practices for climate resilience;
- Undertake or oversee pilot projects designed to improve resilience and sustainability of the natural and built environment along Connecticut's coast and inland waterways;

- Create a climate-literate public that understands its vulnerabilities to a changing climate and which uses that knowledge to make scientifically informed, environmentally sound decisions;
- Foster resilient and sustainable communities – particularly along the Connecticut coastline and inland waterways – that can adapt to the impacts and hazards of climate change; and
- Reduce the loss of life and property, natural system and ecological damage, and social disruption from high-impact events.

INTRODUCTION – LOCAL ENERGY RESILIENCE

The modern electric grid, largely constructed in the 1950s and 60s, is hailed as one of the greatest inventions in human history. In a sort of Rube Goldberg fashion, power is typically centrally generated, moved long distances over transmission lines that cut through forests and fields, is reconfigured at substations, and then downgraded to the local distribution lines that carry the electricity overhead along streets to homes and businesses. Unfortunately, the generation part of this system was designed to be powered almost exclusively by fossil fuels – coal, gas, and oil – which results in the discharge of pollutants such as CO_2 into the air. These fossil fuel generators are now recognized as one of the greatest contributors to climate change – estimated, as of 2020, to contribute approximately 25% of all anthropogenic U.S. greenhouse gas emissions. [2] Fossil fuels power the grid, but their devastating, climate change-exacerbating impacts also weaken it. The catastrophic storm events triggered or exacerbated by climate change often knock down the pieces of this same grid that carry the electricity – the overhead distribution lines – which creates a self-perpetuating and vicious circle. From 2010 to 2021, there were 986 weather-related power outages in the United States, nearly twice as many as in the previous 11 years.[3] Smaller, distributed, locally sited renewable energy and energy storage solutions (ESS or batteries) could help break this circle. Sited correctly, these projects can simultaneously reduce the grid's thirst for

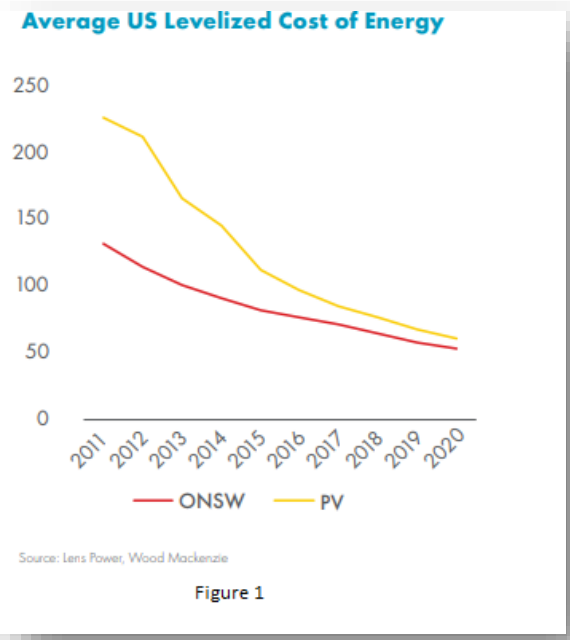


Figure 1

harmful fossil fuels, reduce the need to move power long distances on overhead circuits, provide clean and reliable back-up power if the grid does go down, and set the stage for a cheaper energy supply future. Wind and sun are inexhaustible resources and will be cheaper – overall in the long run – than coal, gas, and oil. This is especially true when considering favorable factors such as resiliency, energy security, public health, carbon offsets, lesser line losses, power quality, and other ancillary services that renewable energy can provide.[4] Onshore Wind (ONSW) and solar photovoltaics (PV) continue to get cheaper (see Figure 1).

Further, the transition to a more renewable energy based and distributed grid could be particularly helpful to many of Connecticut's low income and minority communities – sometimes referred to in Connecticut respectively as distressed municipalities and environmental justice communities, and sometimes for federal grant purposes as Justice 40 communities. These areas often lose power in storm events (grid-edge communities) and do not have the resources or funds to prepare for, or deal with, such emergencies. Further, the energy burden (the percentage of income spent on energy costs) of these communities and their residents is often three times higher than in wealthier towns.[5]

Not only are distressed and environmental justice communities typically less prepared to deal with grid outages, but they are also often the location of highly polluting peaker (or peaking) plants

Peaker plants are generally fossil fuel (primarily gas and oil) powered plants that only run when demand is high (roughly 15% of the time) which in Connecticut typically means hot, muggy summer afternoons.[6] Peaker plants command high prices for their on-demand power; they are often subject to lesser efficiency and emissions standards and as a result they are often the dirtiest generators on the grid.[7] In Connecticut these 19 or so plants are often located near distressed and/or environmental justice communities. (see Figure 2).[8] Air quality around these peaker plants is notoriously poor.[9]

A potential solution to this problem would be to replace these plants with energy storage solutions in these communities. As Connecticut is a net exporter of power (as of 2021 using only about 66% of the power generated in the state)[10] theoretically it has the power to spare to charge these batteries. This would provide for better grid resilience overall, correct a grave environmental injustice and reduce local air pollution in the communities that suffer the most. For example, solar PV is at its best and most powerful on those hot muggy afternoons which so often require peaker plants; and ESS such as lithium-ion batteries can be used to dispatch power during those same

periods – reducing the need for (and eventually replacing) peaker plants. FirstLight Power is looking to do so currently – potentially replacing its peaker plant in Preston, CT with 17 megawatts (MW) of battery storage.[11] Furthermore, the combination of the two – solar PV with batteries along with islanding and other technologies – can be managed as a microgrid when the rest of the grid goes out – creating traditional grid resilience.

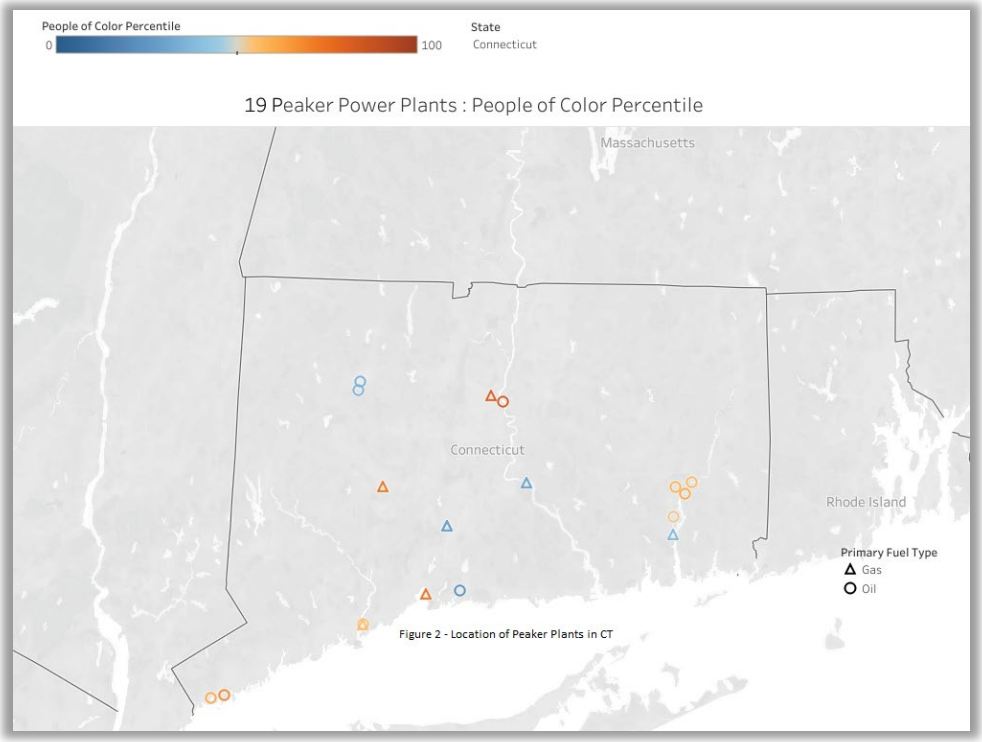


Figure 2 - Location of Peaker Plants in CT

Strategically sited renewable energy and ESS can reduce emissions and air pollutants, provide for a more reliable grid which will keep buildings and communities powered during storm events, and eventually reduce electricity bills in Connecticut (which are often the highest in the continental United States.)[12] There are many new federal and state policies for towns and cities that want to build or host renewable energy projects. These policies will incentivize the development of power generation that uses only or primarily renewable sources of fuel, store power for longer durations, and help communities better prepare for storm events that otherwise could result in grid outages.

The goal of the local energy resilience initiative at CIRCA is to (a) help guide Connecticut communities through the morass of existing federal and state incentives; (b) help municipalities construct microgrids or renewable energy systems that are capable of islanding and operating independently from the grid during outages; and (c) to help municipalities make well-informed choices with respect to selecting and siting renewable energy or ESS generally. Without an understanding at the municipal level of the programs and challenges, the "sustained, cost-effective, affordable and orderly development of Connecticut's clean energy industry"[13] will be difficult, if not impossible, to advance. With the passage of the Inflation Reduction Act (IRA or the Act) on the national level and the launch of several new incentive programs in Connecticut, there is no better time for localities in Connecticut to leverage state and federal incentive money to address their local energy needs. This guide summarizes several of the more relevant federal incentives and state programs specific to Connecticut towns and municipalities.

THE INFLATION REDUCTION ACT OF 2022

The Inflation Reduction Act which was passed into law in August 2022, was an unprecedented investment in renewable energy and climate change mitigation. Pledging roughly $369 billion to clean energy and climate investment, it was considered "the largest single step that Congress has taken to address the root cause of climate change."[14] Its investments are predicted to reduce emissions in the U.S. to between 31% and 44% below 2005 levels.[15] The White House published this IRA Guidebook shortly after passage of the Act

SUMMARY – PRE-IRA FEDERAL INCOME TAX CREDITS

Historically, the principal federal incentive offered to renewable energy project developers has been a federal income tax credit, based on either the total cost (basis) of a project or the annual production of a project. The former credit, called the investment tax credit (the ITC), applied to multiple types of energy projects. The latter credit, called the production tax credit (the PTC), generally applied only to wind projects, and was based on the amount of energy, in kilowatt hours (kWh), that a project produced. Prior to IRA, these benefits were only available to entities that paid federal income taxes. A tax credit is a dollar-for-dollar reduction in the income taxes that the entity that claims the credit would otherwise have to pay the federal government. Therefore, towns and cities (which do not pay federal income taxes) that wanted to transition to clean energy were disallowed from directly participating in this incentive. They often had to attempt to monetize a fraction of this project benefit through a for-profit entity that resulted in no other choice but to lease their land, parking lots or rooftops to private developers. Without these tax credits, renewable energy projects are often completely unaffordable for non-taxpaying entities like municipalities and towns.

DIRECT PAY

The Direct Pay Provision[16] in the Act attempted to fix the aforementioned problem and allows local governments to directly benefit from IRA's tax credits. It added a new section to the tax code, which allows tax-exempt entities – such as municipalities – to be paid in cash in lieu of relying on taxable entities to make a clean energy project affordable.[17] This provision will allow local governments to build and own renewable energy projects themselves.

The direct pay provision is quite straightforward and will function as follows. During the tax year in which an eligible project is placed in service, the amount of the tax credit that would otherwise apply to that project will be paid to the tax-exempt entity. [18] This program will be applicable for tax years starting after December 31, 2022, and ending before January 1, 2033 (although there is a possibility of its extension beyond the current period of the Act). This provision can be applied to the following tax credits: the PTC, the ITC, the carbon capture and sequestration credit, the clean hydrogen tax credit, the alternative fuel vehicle refueling property tax credit, the advanced manufacturing production tax credit, the clean electricity investment tax credit and production tax

credit, the clean fuel production tax credit, the commercial clean vehicle tax credit, and the advanced energy project credit.[19]

DISCUSSION POINT

With this new optionality, many towns will certainly consider owning their own renewable energy systems. However, many towns – especially smaller towns without a planner, town engineer, sustainability director or particularly knowledgeable public works director – are not equipped to develop, construct, or own larger or more complex energy systems. There are numerous challenges a town will have to face if it opts for ownership, including but not limited to: raising capital to fund a significant portion of the project (the direct pay check would not come until after commercial operation), the risk of a project failing after town development monies have been expended, and a general lack of in-house expertise in navigating the incentive, construction, legal, interconnection and operational hurdles. Further, towns can lack the entrepreneurial drive and industry knowledge to maximize a project's efficiency and production over the long term or to take advantage of potential upgrades, which has proven problematic for projects in the past.


Tracker system stuck facing east - no longer operating

Unmaintained thin film system - no longer operating

Without dedicated municipal staff and attention, projects can fail from operational neglect

Regardless, towns that desire to own projects should consult with attorneys or energy consultants before proceeding. Even understanding what costs are eligible for the ITC or the direct pay option can be challenging. For instance, some towns have been under the mistaken impression that the ITC applies to everything that touches a project such as a new roof or new electrical equipment. If the structural integrity of the roof is not strong enough for solar PV, the delta to upgrade the structural component can be included as part of the basis for the project and therefore ITC eligible, but not necessarily the whole roof.

Further, the single digit financial returns for most of these projects are not or should not be enough to incentivize many towns to take on the added risk of ownership. While the option for municipal ownership of projects is more attractive than it was previously, the option should be approached by towns with some caution. Regardless, whether owning a project or leasing a rooftop, parking lot or land to a private company, it is important for Connecticut localities to understand the benefits, nuances, and challenges in the industry to better position themselves from a strategic resilience and financial standpoint.

ITC

Perhaps the most important effect of IRA is that it stabilized the ITC itself which was in the process of being phased down at a rate of 4% annually. Under its prior scheduled stepdown the ITC would have been set at 22% for projects starting construction in 2023.[20] As indicated above, the ITC provides a tax credit for certain investments in renewable energy development, including solar, fiber-optic, fuel cell, small wind, offshore wind, combined heat and power and waste energy recovery.[21] The base tax credit for the ITC will now be 6% of project costs,[22] including interconnection costs for projects under 5 MWs [23] but this percentage can easily be bumped up to 30% of project costs if certain prevailing wage and apprenticeship requirements are met, or if the facility produces less than 1 MW (AC) [24] of power.[25] It is anticipated that all renewable energy projects, given the need for the 30% tax credit, will meet the prevailing wage and apprenticeship requirements. As discussed in more detail below, many renewable energy projects in Connecticut are already subject to prevailing wage state rules that match the Act's wage requirements. So practically speaking the base ITC, absent extraordinary circumstances, can be assumed in Connecticut to be 30%.

PTC

The Act also stabilized, and expanded the technologies eligible for the PTC, and applied the direct pay provision to it. As indicated earlier, the PTC is a per kilowatt hour credit that applies to energy generated in the first ten years of an eligible project's life. Eligible projects will be able to receive a base credit amount of 0.3 cents per kWh, adjusted for inflation annually by multiplying the base credit amount by the inflation adjustment factor for that calendar year. For projects placed in service prior to taxable year 2022 the PTC, after the inflation adjustment factor, was 2.6 cents per kWh.[26] The PTC is subject to the same wage and apprenticeship requirements and the same, domestic content, and energy community and other adders as the ITC.

Perhaps the most significant change that the Act has made to the PTC is that it is now applicable to solar, as well as wind projects, biomass, geothermal, landfill gas, municipal solid waste, and certain hydropower, green hydrogen and geothermal facilities.[27]

DISCUSSION POINT

Whether or not a town or private developer should avail itself of the ITC or the PTC will require a thorough financial analysis, balancing factors such as the efficiency or projected production of a project, the cost of construction and whether, due to town financial planning, one would prefer the payment upfront (ITC) or over a 10-year period (PTC).

TECHNOLOGY NEUTRAL TAX CREDITS

The ITC and PTC only apply to projects that go into service by 2024, but the Act provides similar coverage after that in the form of technology-neutral, or clean tax ITCs and PTCs. This new

incentive extends into 2034, when it will begin to phase out absent new legislation. Whereas the classic ITC and PTC apply to specific types of projects, the technology-neutral credits run on an emissions-based framework that is "neutral and flexible between clean energy technologies." If the project has emissions at or below zero, it will qualify for these credits.[28] This 10-year runway for these federal tax credits is seen as one of the most impactful aspects of IRA – providing certainty to an industry formerly vulnerable to congressional whims and expiring or declining incentives.

PREVAILING WAGE AND APPRENTICESHIP REQUIREMENTS

As indicated earlier, the PTC, ITC and technology neutral tax credits drop dramatically if a developer does not meet prevailing wage or apprenticeship requirements. The Act requires that all workers involved in the construction, alteration, or repair of any of these eligible energy facilities must be paid the prevailing wage, as defined by the Secretary of Labor. If this requirement is not met, it can be cured, among other ways, if the underpaid worker is compensated with the difference between what they were paid and what they should have been paid, plus interest.[29] Notably the prevailing wage and apprenticeship requirement only applies to projects over 1 MW in size.

The apprenticeship requirements will need to be further defined, but the Act does lay out the basic details. A certain minimum percentage of the work on these projects must be completed by a qualified apprentice who is participating in a registered apprenticeship program: 10% of total labor hours for projects that begin construction before January 1, 2023; 12.5% for projects that begin construction in 2023; and 15% for projects that begin construction on or after January 1, 2024. Like wage requirement violations, apprenticeship violations can be cured by: (1) a penalty payment to the Secretary of Labor of $50 per non-compliant hour (or $500 per hour if the violation is found to be intentional), or (2) establishing that a good faith effort was made to find apprentices, but failed because of a lack of available apprenticeship programs.[30] Further details are still to come.

DISCUSSION POINT

Fortunately, this requirement should not represent a huge cost increase for energy developers in Connecticut, who, for post-2021 projects over 2 MW AC, have to meet state prevailing wage requirements.[31] It should be noted that several of Connecticut's environmental permitting thresholds also sit at 2 MW so there are other reasons for solar PV developers in particular to size projects just under 2 MW – depending on whether or not the benefits of scale outweigh the lesser regulatory scrutiny. Regardless of the project ownership structure, vetting whether a developer will qualify the project for the ITC/PTC benefits is key, especially with respect to the apprenticeship requirements.

DOMESTIC CONTENT

Both the PTC, ITC and technology neutral credits can be bumped even higher if certain domestic content requirements are satisfied (which adds 10%, for instance, to the ITC).[32] The domestic content requirement is satisfied if (i) 100% of any steel or iron that is a component of the facility

was produced in the United States, and (ii) 40% of most manufactured products that are components of the facility were produced in the United States. For manufactured products, such products will be deemed to have been produced in the United States if not less than 40% of the total costs across all such manufactured products of such facility are attributable to manufactured products that are mined, produced or manufactured in the United States.[33]

The US Treasury released preliminary guidance on May 12, 2023, to help developers navigate the domestic content waters. Regulations are still forthcoming. Among other things, Notice 2023-38[34] clarifies that the steel and iron requirement does not apply to components or subcomponents of manufactured product (i.e. nuts, bolts, washers, hinges, etc.) and also applies an Adjusted Percentage Rule to be applied to all manufactured projects. Generally, under the Adjusted Percentage Rule, "all manufactured products included in a project are deemed to be produced in the U.S. if the Domestic Cost Percentage of a project equal or exceeds the applicable domestic content adjusted percentage (generally 40% or 20% in the case of offshore wind projects)."[35]

DISCUSSION POINT

Until there is a significant increase in domestic manufacturing, it will be challenging especially for solar PV developers to try and meet the domestic content requirements. The economics currently do not favor buying domestically. One can purchase solar PV panels for approximately $1.30/watt from foreign suppliers in comparison to approximately $1.50/watt domestically, negating much of the benefit of the 10% domestic content bonus credit. Further, as developers often contract in advance in bulk in anticipation of future needs, they will probably not be able to take advantage of the domestic content bonus for at least 18 months. Notice 2023-38 also sets forth a confusing test to meet the domestic content hurdle. The test does not seem to consider the challenges of detailed information gathering in a complicated global supply chain for most manufactured parts and labor. Towns (or developers) with respect to solar PV should not rely on this incentive for projects expected to go into commercial operation within the next year. It is important, however, for towns to be aware of the eventual availability of this financial benefit to a town-owned project or a privately owned one located in their jurisdiction.

ENERGY COMMUNITIES

Another new tax incentive provided by Congress through IRA was the potential to add another 10% to the ITC or a 10% multiplier to the PTC if a project is in an energy community.

Energy communities are generally defined in 3 categories:

1. A metropolitan statistical area or non-metropolitan statistical area that has (or had at any time after 2009):
    - 0.17% or greater direct employment or 25% or greater local tax revenues related to the extraction, processing, transport, or storage of coal, oil, or natural gas; and

- has an unemployment rate at or above the national average unemployment rate for the previous year;

2. Coal Closure areas: A census tract (or directly adjoining census tract)
   - in which a coal-fired electric generating unit has been retired after 2009[36]
3. Brownfields: Brownfield sites are defined under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) definition: "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant."[37]

However, there are numerous exceptions under CERCLA to the definition of a brownfield – notably sites that are the subject of planned or ongoing removal under CERCLA, facilities otherwise subject to court or administrative orders or decrees, and sites permitted under or subject to corrective action under RCRA. Towns should double check to ensure a brownfield within their borders fits within this definition before assuming the 10% adder applies.[38]

Recent guidance regarding energy communities released by Treasury on April 5, 2023, did not narrow this list of exceptions but did provide a safe harbor for brownfields not falling under the list that includes sites:

- previously assessed through federal, state, territory, or federally recognized Indian tribal brownfield resources as meeting the definition of a brownfield site under 42 U.S.C. § 9601(39)(A)
- where a Phase II Environmental Site Assessment (ESA) confirms the presence of a hazardous substance, or a pollutant or contaminant on the site; or
- where a Phase I ESA has been completed for projects with a nameplate capacity of 5MW (AC) or less. [39]

A project also has to meet either the nameplate capacity test or the footprint test to be eligible for the additional credit. Under the nameplate capacity test, a project is considered located within an energy community if 50% or more of the project's nameplate capacity is in an area that qualifies as an energy community. Under the footprint test, a project is considered located in or placed in service within an energy community if 50% or more of its square footage is in an area that qualifies as an energy community.[40]

A map of the non-brownfield Energy Communities in Connecticut can be accessed here: [Energy Community Tax Credit Bonus] and is depicted below in Figure 3 (the map can change annually).

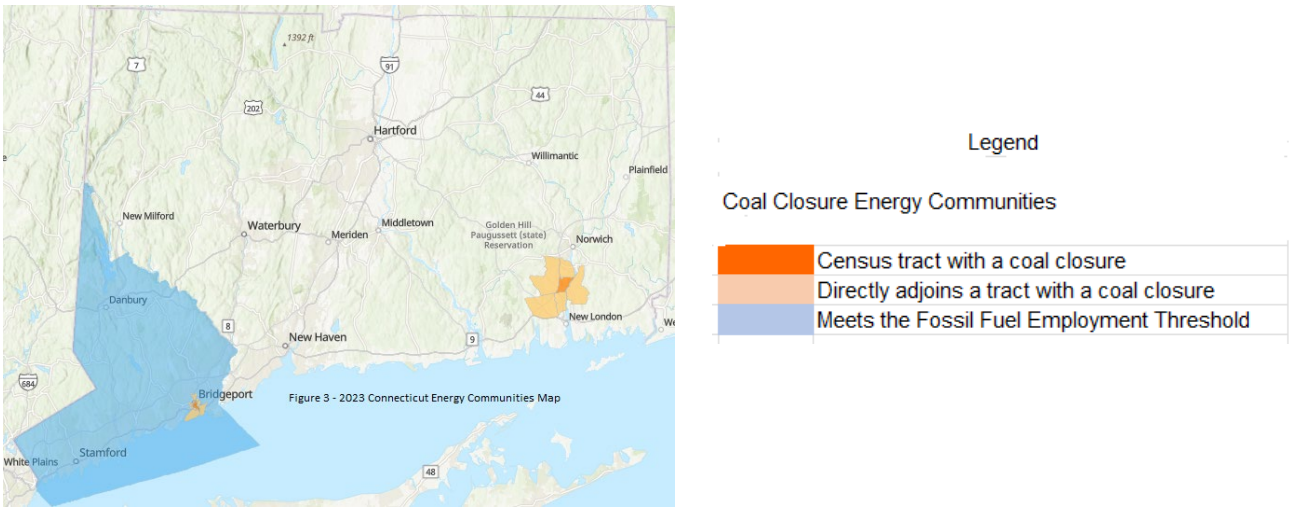


Figure 3 - 2023 Connecticut Energy Communities Map

As can be seen, projects in SW CT and SE CT can potentially benefit from the Energy Community incentives due to the shuttering of the Bridgeport Harbor Station coal plant and the Thames Generation coal plant, respectively.

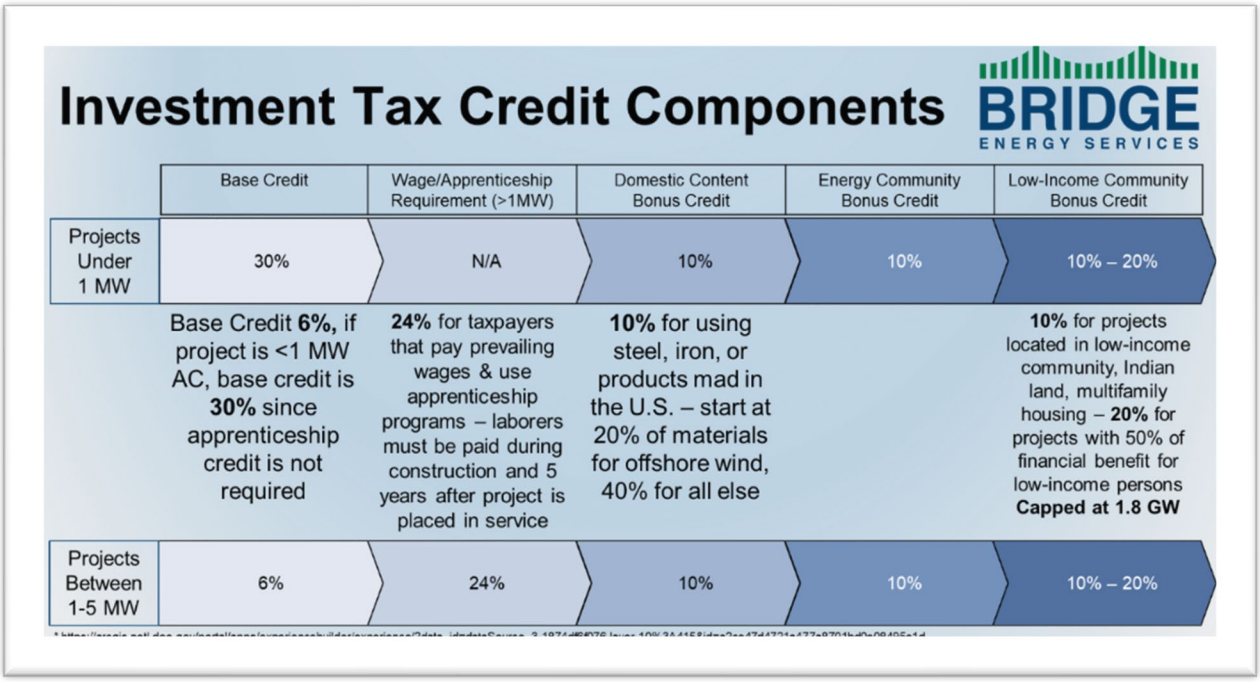
LOW INCOME COMMUNITY CREDITS

Under IRA, projects sited in low-income communities could bring an additional 10% on top of the 30% ITC and even an additional 20% if the project is part of a qualified low-income residential building project or a qualified low-income economic benefit project. Recent guidance from the U.S. Treasury indicates that there will be 1,800 MW/DC per year awarded in this low-income category in 2023 and 2024.[41] Only solar, wind, or integrated storage projects will be eligible, and they cannot be operating prior to application, must be under 5 MW; and the ITC is the only tax credit applicable. The 10% bonus for projects sited in low-income communities will be capped at 700 MW in 2023, and the New Market Tax Credits (NMTC) maps will be the guide as to whether a community is considered low income. See the Cohn Reznick NMTC Map to determine if your community would qualify under this program. To be eligible for the 20% low-income benefit, also capped at 700 MW in 2023, the project must be installed on affordable housing and the tenants must receive the financial benefits or at least 50% of the financial benefits must be provided to low-income households.[42]

DISCUSSION POINT

When negotiating leases, power purchase agreements (PPAs), or net metering credit agreements, it is important for towns to understand the various tax and state incentives benefiting developers. Towns should ensure that they reap some of the benefits of potential additional tax credits that go beyond the base credit such as the 30% ITC. Given the low number of MW allocated nationwide to projects sited in or benefiting low-income communities annually (700 MW in each program

annually to start) towns should not rely on these benefits.



A section should be added to a lease or PPA allocating some of this extra benefit to the town. A one MW ground-mounted solar PV project can cost over $1.5 million, so an extra 10% in tax credits could mean an additional $150,000 to the developer. In these situations, a town could potentially ask for more in the lease or in terms of electricity savings in a PPA. Given the risk of these extra tax credits not being available, developers do not often rely on this uncertain, additional benefit when evaluating a project's financial viability so sharing at some level in this type of benefit if it transpires should be acceptable in most circumstances.

BATTERIES OR ENERGY STORAGE SOLUTIONS

Prior to the passage of IRA, batteries were only eligible for tax credits if they were coupled with (powered largely by) a renewable energy source. IRA changed that and made standalone batteries (and other standalone energy storage projects, like thermal energy storage properties) eligible for the ITC.[43] To be eligible, a battery project must have a capacity of no less than 5 kWh. Additionally, any storage property that was placed into service before IRA's date of enactment and has a capacity of less than 5 kWh, can be modified to increase capacity and thus, be eligible for the ITC. [44] The ITC for standalone storage, or storage coupled with solar, is now 30%, with a 10-year fixed term, with optional add-on benefits, just like the classic ITC structure, explained above. It is predicted that the new tax credits included in IRA will have monumental impacts on the energy storage industry.[45]

Another driver for energy storage is its potential ability to turn intermittent technologies into dispatchable ones. Solar PV is an intermittent resource – it only works during the day and when the

sun is shining. Solar-charged batteries, however, could supply power on demand and at night or when the solar array is not otherwise generating.

Similarly, utility scale batteries (stand-alone batteries tied most often to the transmission system) also can add to grid resiliency, by supplying peak power on demand – power on hot and humid mid-summer days when the grid is strained. In circumstances where peak power is required, batteries could eventually obviate the need for inefficient, costly, and polluting peaker plants, which, in Connecticut, are often located in environmental justice and low-income communities.

Batteries could also potentially replace diesel or gas-fueled generators as a short-term backup source when a downed wire, for instance, disconnects a building from the grid. A common microgrid model involves solar PV coupled with a battery, capable of islanding or disconnecting from the grid, along with an inverter containing microgrid controls. Typically, grid-connected solar or a solar/battery system- is tied to an inverter which contains an anti-islanding device – meaning the solar power is prevented from feeding power to the grid when there are grid outages – partly for safety reasons. The utility does not want power fed to a downed wire. Without microgrid controls, these systems are essentially shut down until the grid is repaired. However, with the proper inverter and microgrid controls, when in islanded mode, the solar PV can continue to power the building along with the coupled batteries. A thorough understanding of the energy demand of the building, the fluctuation in production of the solar PV, and the capacity of the battery along with other factors is required to successfully manage a microgrid like this and to maximize its duration.

DISCUSSION POINT

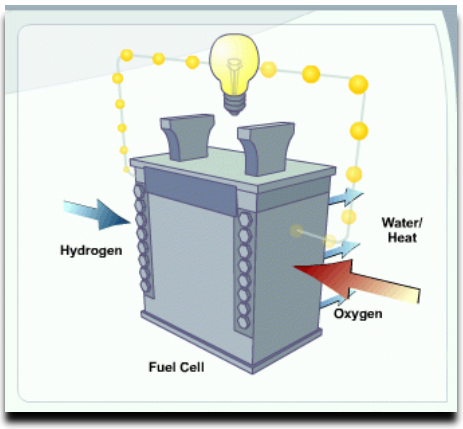
Even though lithium-ion battery prices have dropped significantly over the last decade they are still relatively expensive, and their discharge duration is limited considering the expense. For instance, a 10-kWh battery (battery capacity is measured in kilowatt hours) which costs roughly $5,000[46] could keep the refrigerator running, some lights on, maintain hot water, and keep computers and phones charged for roughly one day for an average Connecticut home during a power outage. Alternatively, it could power an electric furnace for about an hour, or central AC for about 3 hours. Solar can recharge the battery during the day, but solar produces significantly less in the winter than in the summer in Connecticut, so the long winter recharge time would negatively impact how much power one could use both during the day when the solar is running and at night. In comparison a natural gas generator of a similar size and price, connected to a natural gas service

line, could fully power (no demand management required) the average residence in Connecticut indefinitely with all the appliances and utilities running.

As a result, until longer durational batteries are developed, or until it becomes cost effective to daisy chain multiple batteries together, the immediate incentive for Connecticut towns to install batteries will probably not be for a long-term back-up power supply. They could instead be motivated by opportunities to lower electricity prices or to lessen their environmental footprint. Batteries can provide valuable economic benefits - such as demand price and capacity tag (cap tag) reduction or arbitrage opportunities. Utilities can apply demand charges based on the maximum amount of power a town may use at each of its meters over a 15-minute interval, which can make up a disproportionately large part of an electric bill. Strategically discharging a battery to reduce one's monthly peak demand during periods of high usage in general can reduce utility costs significantly. Further, if batteries can be effectively discharged when the grid is likely to peak (e.g., August 4, 2022) - when cap-tags are set - a town can significantly lower its future supply contract costs associated with capacity. Also, certain Eversource Energy (Eversource) and The United Illuminating Company (UI) rate classes are priced according to a customer's time of use, so there are possible future arbitrage opportunities for battery owners – buying cheap power to store and dispatch when power prices are high. As described below, Connecticut also provides significant programmatic financial incentives for towns to install energy storage that also gives the utilities access to the batteries during peak demand periods.

FUEL CELLS

As indicated earlier, fuel cells utilize hydrogen molecules in the fuel source (which primarily comes from reforming natural gas) to produce electricity via electrochemical reaction.[47] The result is highly reliable, combustion-free electricity with accompanying significant life cycle reductions in carbon emissions (roughly a 50% reduction compared to a natural gas-powered plant).[48] Electricity, water and heat are the main byproducts.[49] Fuel cells are also often developed as Combined Heat and Power (CHP) projects, where heat generated from the fuel cell operation is captured and utilized to further improve the efficiency and economic benefits of the system by applying that heat to reduce on-site heating costs (e.g., domestic hot water).



Fuel cells have a very high-capacity factor of around 95% especially when compared to solar in Connecticut which is typically around 15%.[50] Capacity factor is generally defined as the ratio of the electrical energy produced by a generating unit for the period as a percentage of the electrical energy that could have been produced at continuous full power operation during the same period.[51] The minimum commercial size for a fuel cell is generally 250KW although most practical applications are larger than this. A 250-kW fuel cell would

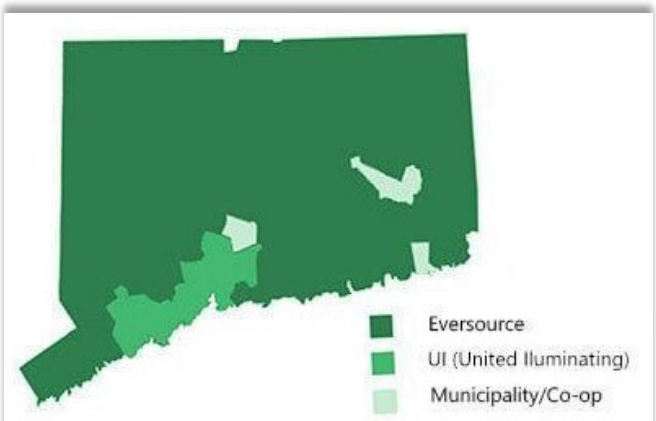
generate approximately 2,000,000 kWh per year continuously. In Connecticut the same sized solar PV system would produce (depending on numerous factors) around 400,000 kWh intermittently.[52]

Unlike solar PV, fuel cells operate continuously as long as they are being fed fuel.[53] They are designed to always be on. They are not reliant on ambient conditions, do not need to be re-charged, and feature optimal operating efficiency at maximum output. Because of their dependable nature, fuel cells are typically deployed as the primary or base load power source for a building and can be installed in varying grid arrangements (grid-parallel or microgrid islanding outage protection) depending on the needs of the site.

Fuel cells can offer a potential pathway to zero-carbon electricity production, and there are significant incentives in IRA to help them get there. In Section 45V of IRA, Congress applied the PTC to qualified clean hydrogen with the highest credit level set at $3 per kilogram of hydrogen which could account for 60% of the average total cost of production.[54] The Act defines "qualified clean hydrogen" as hydrogen that is "produced through a process that results in a lifecycle greenhouse gas emissions rate not greater than four kilograms of CO2e per kilogram of hydrogen." The Act also introduced the ITC to specified clean hydrogen facilities.[55] To capture these credits, a fuel cell would potentially have to use renewable energy (not natural gas) to power an electrolyzer – the device that splits water atoms into hydrogen and oxygen feeding the fuel cell with the hydrogen it needs to create power.[56] If solar PV is used to power a hydrogen electrolyzer, the PTC would be applicable. As indicated earlier, most commercial applications in Connecticut presently, however, are a non-combustion process using natural gas that strips the hydrogen for use in the fuel cell.

CONNECTICUT PROGRAMS

Along with IRA, the state of Connecticut has recently launched several new programs to help accelerate the development of clean hydrogen, fuel cells, energy storage, and solar PV projects. Fuel cells and solar PV are also designated as a Class 1 renewable energy resource in Connecticut and therefore eligible, when available, for the most valuable renewable energy certificates (RECs), which can be a significant portion of the revenue stream for a generator. When operating outside the two main Connecticut incentive programs, these RECs are available for generators, although, as explained below, the two programs fold RECS into the overall bid price. As of 2022, Connecticut had roughly 1,1161 MW of solar, around 100 MW of fuel cells, 3 inland wind turbines and a handful of operating ESS.[57] The largest fuel cell in the US (as of 2021) is in Bridgeport and has approximately 16 MW of generation capacity.[58] Offshore



Connecticut Electric Distribution Company Territory Map

wind, nuclear, or other transmission-tied (large) generators are not a focus of this guide.

There are two principal programs through which solar and fuel cell power are currently developed and monetized in Connecticut: the Non-Residential Renewable Energy Solutions (NRES)[59] program, and the Shared Clean Energy Facilities (SCEF) program.[60] In both programs the generators bid on a price that includes both power and RECs (the utility retains the RECs). These two programs are aimed at Connecticut's two investor-owned electric distribution companies: Eversource and UI and not the municipal electric utilities.[61]

NRES PROGRAM SUMMARY

NRES is a bi-annual reverse auction (the lowest priced bid wins) with program and project-size caps and that is geared towards projects that have onsite power consumption (load) or that are located on state, municipal or agricultural (SAM) land. There are different tranches in the program, one of which allows low emission projects (i.e., fuel cells) to compete against zero emission projects (i.e., solar) up to 5 MW in size and another three, 0-200 kW, 200 kW-1 MW, and 1MW-5MW, for which only zero emission sources are eligible. Generally, the smaller the project the higher the per kWh the bids will be. The highest pricing has been seen in the ≤200 kW zero emission projects, where prices are fixed and projects are selected on a first-come first-serve basis, followed by the middle tranche of 200 kW to 1 MW. The lowest prices typically occur in the 1 MW to 5 MW tranche for zero emission projects and the tranche in which low emission projects compete with zero emission projects between 0-5 MW. As of the date of this guide, there are 5 years left in the NRES program which in total is capped at 360 MW (i.e., the last NRES auction year will be 2027), with 110 MW being granted each year divided among the different tranches and between the two main utilities.

Within this program there are three options for towns or private developers selected by towns: (1) sell power directly to Eversource or UI (called the buy-all option); (2) offset onsite load in a more traditional net metering fashion, or; (3) SAM customers (only) can participate in virtual net metering, that is, offset some onsite load and allocate the rest (via financial credits) to other electricity bills, using vacant and sometimes unmetered SAM land, which is a significant advantage in this program.

The NRES program has other significant incentives to entice developers to build solar carports, projects on brownfields, capped landfills, or projects behind load in distressed municipalities (or in the case of SAM customers projects that benefit distressed municipalities by crediting electricity savings to these communities).[62] In each of these cases a project developer receives a 20% bid priority (30% in the case of carports) in the auction. So, if a town or a private developer were to bid, for instance, 10 cents per kWh as a buy-all option in the auction, the bid for the landfill project would be evaluated as if it were 8 cents per kWh, giving it a much better chance of success.

DISCUSSION POINT

Developers approaching towns in Connecticut to lease vacant land are most often doing so in preparation for an NRES bid, as private, vacant, non-agricultural land is not permitted in the virtual net metering portion of this program and gaining control over state land is often too arduous a process. Although technically the statute seems to limit this option, in practice, SAM customers have also been able to mix and match with each other. [63] For instance, there can be a large agricultural parcel in Avon with a meter but limited load onsite. The owner could take advantage of the NRES program by building a 5 MW project (roughly 20 acres) on the property and selling the rest of the power to Torrington. This benefit is not afforded to private non-SAM landowners. Program rules and interpretations can change annually so it is valuable for towns to consult with experts –groups like CIRCA or a private consultant – before embarking on an NRES project.

SCEF PROGRAM SUMMARY

The second major program in the state that incentivizes solar and fuel cell projects is called the SCEF program. SCEF is often referred to as community solar but traditional community solar, in the way that most people imagine, does not exist in Connecticut. It is not entirely clear if the traditional community solar model originally envisioned- where a group of neighbors invest in a single array and share in the electricity produced - exists anywhere in the country outside of contained microgrids. In a typical northeastern US community solar program or project, members of the local community (or in most cases customers of the same utility) volunteer to share in some form of electricity savings from a project sited in the same community or utility territory. The developer is typically the entity working directly with the public in these instances with the utility administering the savings on its behalf. While SCEF does involve the allocation of financial benefits from projects ($.025 per kWh) to the public, , it differs from typical community solar in that the utility is the sole entity responsible for selecting the community to receive the savings along with administering them. In SCEF, Eversource or UI allocates the financial benefits based on a stakeholder-vetted process[64] grounded in the guiding statute authorized in Public Act 19-35[65] prioritizing low-income state residents. In some instances, the local fuel bank, Operation Fuel,[66] is involved in vetting the customers to whom the financial benefits of the SCEF are distributed. From the local town's perspective, these SCEF projects are just solar PV or fuel cell projects selling power to Eversource or UI with the only benefit to the town being new personal property taxes and an increase in real property taxes. Like NRES, SCEF projects sited on brownfields, landfills or which involve parking lot solar canopy projects are all given a 20% or 30% price advantage, respectively, in the bidding process.

DISCUSSION POINT

	NRES Program	SCEF Program
Project Maximum Size (MW)	5	5
MW offered per year	110	50
Total Program Size (MW)	500	300
Program Years Remaining	5	5
Different Environmental Rules		No construction in core forest or on slopes > 15°
Structure	Virtual net metering or direct sale to utility	Direct sale to utility w/utilty distributing some financial benefit back to community
Pricing differences based on size	Different tranches/auction for different project sizes	One tranche/auction regardless of size
Special ground siting restrictions	State, farm or municipal land only	
Siting incentives	Distressed municipalities, brownfields, carports and landfills	Brownfields, carports and landfills

Basic Differences between the NRES and SCEF Programs

The pricing under NRES has historically been better for developers, as compared to SCEF, so towns should expect better overall financial benefits from this program (higher lease payments, higher negotiated tax payments, and the possibility of electricity savings). It is not clear if the pricing in these two programs will eventually converge and not differ materially. Few projects to date are operating under SCEF, most likely given the low pricing in the auction. The complete ban on projects in core forests and on steeper slopes could also be a factor. Some capped landfills have steep slopes. Further, the rules and nuances of both Connecticut programs can be complicated – and can change yearly with legislation and different interpretations and letter rulings – so it is recommended towns work with entities like CIRCA or hire private consultants early in the process. Some of the siting incentives and restrictions differ in the two programs so understanding the nuances between the programs is important and underscores the importance of working with entities experienced with these programs. Ideally the legislature or the agencies they instruct will make practical changes in the years ahead to these programs, to focus on building good projects in appropriate areas of the state without the need for continual regulatory refinement.

INTERCONNECTION

The new ability to apply tax credits to interconnection costs on projects under 5 MW[67] is one of the most significant new incentives under IRA as high interconnection costs are often project killers in solar saturated markets (like Connecticut) and rural (low load) markets. High interconnection costs, expensive interconnection studies and long interconnection queues are issues nationwide for both small and large generation projects.[68] Costs to interconnect with the grid are borne by the developer, and anything that reduces costs of interconnection will significantly help spur development.

In the past, there was a lack of visibility on where on the grid a developer should look to interconnect – that is where they can put the most power at the lowest cost. However, in Connecticut, both UI and Eversource have published maps in the last several years showing the amount of new generation they estimate each circuit (or section of circuit) can handle without significant upgrades.

- Eversource Hosting Capacity Map
- UI Hosting Capacity Map

Conversely with fuel cells, there used to be much more publicly available information about where high-pressure gas needed was available, but security concerns have reduced what is in the public domain. To determine natural gas hosting suitability, a town will need to reach out to the gas utility provider with a specific address.

DISCUSSION POINT

Towns can anticipate energy development through an understanding of how much capacity each circuit has in the town as capacity is one of the biggest reasons that an area or parcel will be targeted by a developer. Costs to interconnect to a circuit can range from around $130,000 per MW to $1,000,000. The latter figure, or anything close to it, makes a project unbuildable. Further, it is not uncommon for larger projects on more crowded circuits to be subject to a system impact study of the potential effects of the project – not just at the local circuit level but at the transmission level – something that can cost a developer around $75,000 and cause significant delays in the project development schedule. This is typically not the case for projects under 1 MW in size. Further, one has a better chance of manageable interconnection approval timelines and eventual costs imposed on projects when the generation will be used by onsite load most of the time. Large projects on vacant land in rural (low load) areas can run into significant difficulties or face expensive upgrades in connecting to the grid.

From a public policy perspective, siting solar PV projects on the smaller end, next to or close to load also seems to make more logical sense in a state such as Connecticut. Solar PV was invented as a distributed generation source - something to be conveniently placed on rooftops or close to load, and not necessarily as a large, utility scale generation source, especially in the Northeast. Utility scale (grid-scale)[69] scale solar PV projects do not produce enough power (especially in the wintertime) to justify, in most circumstances, the amount of acreage they occupy in a populated Northeast, especially when it comes to their impacts on prime farmland soils, open field habitat, forests, and biodiversity generally.

SITING INCENTIVES IN MORE DETAIL

LOW INCOME COMMUNITIES (DISTRESSED MUNICIPALITIES)

In NRES, projects with load on-site that are located in a distressed municipality receive a 20% bid preference, and SAM projects that allocate the net metering credits to the bills of a distressed municipality, receive the same bid preference.[70] There are no similar low income-related bid preference incentive for SCEF projects, although as described above, for every kWh produced by a SCEF project $.025 goes to low and moderate-income customers as priorities.[71] Discussions regarding modifications to both programs to potentially include environmental justice community siting incentives could be part of each program's upcoming annual reviews.[72] The Authority has indicated it would consider an update to the distressed municipality bid preference to include environmental justice census blocks as eligible in the next NRES annual review cycle if it finds after the stakeholder process that such a change will better meet the program objectives. The annual review process exists in part to evaluate these programs for potential changes to help better meet each program's objectives. For a map of the distressed municipalities and environmental justice communities in Connecticut see Figure 4 or the [2022 Map of Distressed Municipalities.]

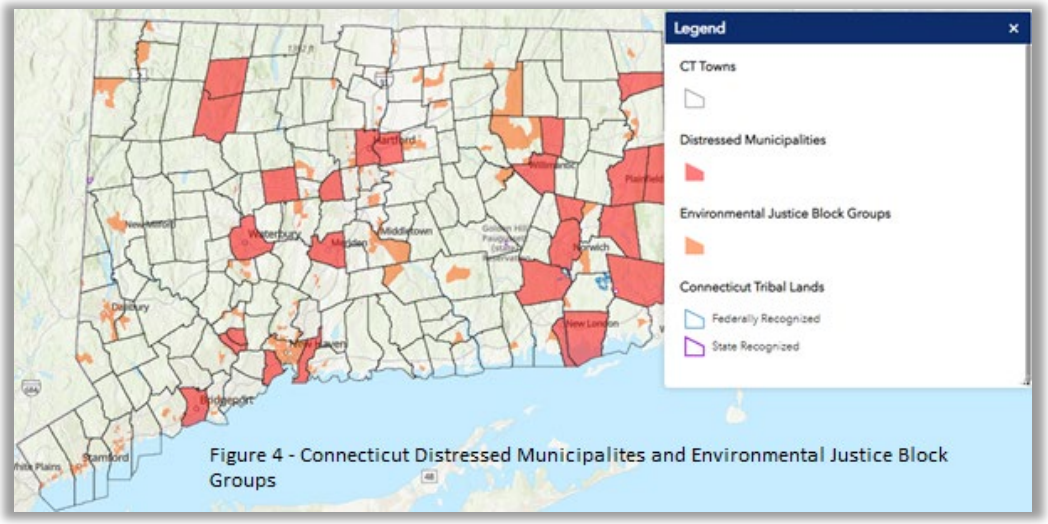


Figure 4 - Connecticut Distressed Municipalites and Environmental Justice Block Groups

DISCUSSION POINT

Stacking IRA low-income tax credits with the incentives offered by the state of Connecticut could provide significant savings or income for Connecticut distressed communities. However, as stated above, given the low number of MW allocated nationwide to low-income projects, towns should not rely on these federal benefits. Together the federal and state programs do offer significant enough benefits that towns should at least check whether they are included in the new market tax credit maps or considered a state distressed municipality – in which case there is at least the potential to stack significant incentives.

BROWNFIELDS, LANDFILLS OR CARPORTS

In addition to the 10% additional tax credit provided under IRA, at the state level, projects sited on brownfields also receive bidding preferences. Both brownfields and landfills in the NRES and SCEF programs are offered a 20% pricing advantage in the bidding process. Connecticut also incentivizes parking lot solar PV parking lot canopies at a 30% bid preference price.

In Connecticut, brownfield, for purposes of most energy projects means "any abandoned or underutilized site where redevelopment, reuse or expansion has not occurred due to the presence or potential presence of pollution in the buildings, soil or groundwater that requires investigation or remediation before or in conjunction with the restoration, redevelopment, reuse and expansion of the property."[73] The definition of brownfield governs all NRES projects. In the SCEF program this year, however, DEEP has limited the types of brownfields available only to those listed in the DEEP Brownfields Inventory. Further, for a project to qualify as a brownfield project, it must be, in most circumstances, at least 75% sited on the brownfield itself, different than the restrictions in IRA.

DISCUSSION POINT

With respect to carports, historically high steel prices have offset in part the incentives offered for solar PV parking lot canopies.[74] High construction costs seem to be the principal reason there is not an abundance of solar carport projects in Connecticut. People's Action for Clean Energy put out an extensive report in 2021 discussing the benefits of solar carports and demonstrating that Connect had at least the space to fit around 7,000 MW of them: Solar Canopies in Connecticut: Siting Potential, Implementation Guidance, and Policy Considerations. From a public policy perspective brownfields, carports and capped landfills are an ideal location for renewable energy projects.

Towns should be prepared, however, to address some of the risks associated with building on a landfill or brownfield. Experts, attorneys, and town insurance brokers should be consulted as to whether environmental insurance or contractors' pollution liability insurance is needed or should be required, protective indemnifications provisions should be included in a lease, or if access to state liability relief or grant programs are available. Further, different installation methods could be required that would minimize disruption to the soil or an underlying membrane if that is a concern. Often, the solar PV projects have to be ballasted, with no underground infrastructure permitted. These methods can increase costs. In most circumstances, however, none of the above represents an insurmountable obstacle to a successful project on a brownfield or capped landfill.

In most cases, given the extra incentives involved, towns could still ask for higher lease prices or greater electricity savings for these projects. Regardless, it is important for towns to understand the incentives and costs that go with these projects to better position themselves before getting too far down the road.

Outside of the federal and state energy-related incentive programs there are other incentive programs related to brownfield remediation and re-development some of them which are summarized here: Siting Clean Energy on Brownfields.

ENVIRONMENTAL RESTRICTIONS, STORMWATER AND OTHER CONCERNS

Beyond the land use issues and the standard laws and regulations regarding, for instance, protection of wetlands, waterbodies, endangered and threatened species, etc. that apply generally to development in the state, there are special environmental rules in both the NRES and SCEF programs that apply to its projects.

Further, unlike other real estate projects, all electric generating facilities or ESS fueled by renewable energy sources over 1 MW in size apply for a single land use permit from a central quasi-judicial administrative agency, the Connecticut Siting Council (the Siting Council).[75] A brief overview of the Siting Council can be found here: Citizens Guide to Siting Council Procedures. Anything equal to or under 1 MW falls under the jurisdiction of the local planning boards and inland wetland commissions. It is beyond the scope of this version of the guide to go into detail on the Siting Council regulations or to provide an overview of all the environmental restrictions that might pertain to energy projects in CT.

Towns should, however, understand, that there are different laws and regulations in Connecticut that specifically apply in the different incentive programs. For instance, generally projects after a certain date and over 2 MW (as indicated earlier) are subject to enhanced scrutiny by DEEP and the Department of Agriculture, if located in core forest or prime farmland respectively. [76] Some larger projects by virtue of legislation, are grandfathered out of some of these project- or program-specific environmental laws and regulations. [77] In the SCEF program projects are not permitted in areas designated as core forest or on slopes over 15 degrees[78], while in NRES these same projects are only subject to a higher level of DEEP review. A good environmental mapping resource is the UCONN CT ECO Map.

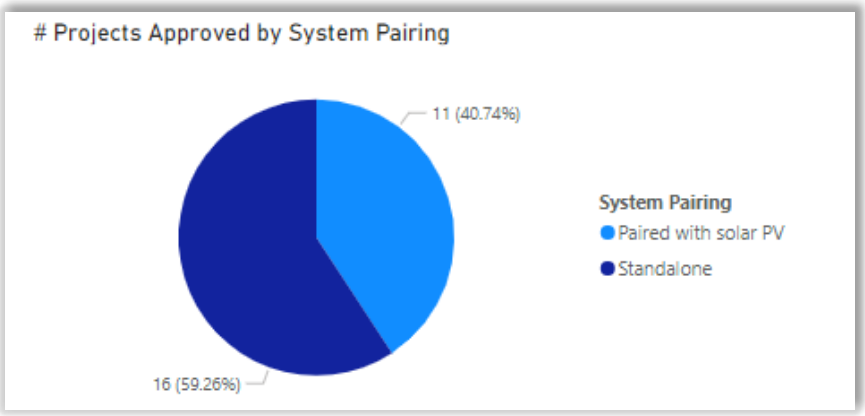
A particular focus of DEEP has been on construction-period run-off from larger solar PV fields. There can be an increase in the peak and frequency of run-off when sites are cleared, and trees are removed to accommodate ground-mounted solar PV. Stormwater issues are a particular focus of DEEP on projects constructed on slopes greater than 5 degrees and for projects with more than 5 acres of disturbance. In these circumstances a higher level of scrutiny is applied. There is a special appendix (Appendix I) in the General Permit for the Discharge of Stormwater governing solar array construction. [79] Appendix I, among the various erosion control measures it requires, also can require a letter of credit to be posted by the owner of an array in an amount between $7500/acre and $15000/acre depending on the acreage disturbed. For a 2 MW project, which can require roughly 8 to 10 acres of disturbance, a developer (including a town as a developer) could be obligated to post a letter in the amount of or exceeding $100,000 that could be outstanding for approximately 2 years. For some developers, letters of credit must be secured with cash, so this is money not available to them during this period– potentially a significant burden.

On top of this there are areas one should avoid from a practical perspective, such as areas prone to flooding. It is recommended that towns contact CIRCA or a private lawyer or consultant to learn more about environmental restrictions in this area.

CONNECTICUT ENERGY STORAGE SOLUTIONS (BATTERIES)

Prior to the passage of IRA, the Connecticut legislature authorized[80] and the Connecticut Public Utilities Regulatory Authority (PURA or the Authority) designed and launched[81] its first ever energy storage program, the Energy Storage Solutions program.[82] The program is being run by the Connecticut Green Bank along with Eversource and UI and more details on it can be found here: Energy Storage Solutions. The program was launched to offer both upfront and operating incentives for batteries. The upfront incentive will decline over time but is currently significant. The incentive applies to the cost of the battery and can cover up to 50% of the battery cost although typically this percentage is lower. Stacked on top of the IRA upfront incentives, the savings on a battery purchase in Connecticut easily exceed half the cost. The performance incentives (guaranteed for 10 years – and declining after year 5) require the battery owner to respond to price signals from Eversource or UI during periods in which discharging the battery would provide benefits to the local and regional grid. The battery owner can essentially manage the battery for its own benefits (for some of the purposes summarized above) outside of some peak periods in the winter and 3-8pm June-August. One does not need to participate in both the upfront and performance incentive programs and depending on one's demand profile it may be worth foregoing one or the other for better operational flexibility.

The program aims to deploy 580 MW of behind the meter ESS by the end of 2030, as part of the state's goal to deploy 1,000 MW of energy storage overall in the same time frame.[83] The program does not distinguish between solar/battery systems and stand-alone batteries, but does currently focus on projects sited at residential and industrial and commercial-end users (the battery has to be sited where there is load – also termed behind the meter) as opposed to stand-alone batteries connecting directly to the grid and not tied to any load. According to the Connecticut Green Bank, "27 projects in the first commercial and industrial tranche were submitted to the Green Bank program for funding by six project developers representing 20 towns and several water treatment plants, manufacturing facilities, public schools and health clubs."[84] The performance report for the first tranche can be found here: Energy Storage Solutions Performance Report. Notably, 41% of the projects approved consisted of batteries coupled with solar PV – a good starter package for a microgrid.



The next tranche of 100 MW was launched at the end of March 2023, roughly 2 years ahead of schedule and in part due to the strong demand for the first 50 MW.[85]

Further, priorities for the Connecticut battery program include a focus on low- and medium-income customers, critical facilities and customers on the grid edge. According to the Energy Storage Solutions project, customers on the grid edge are defined as (1) the top ten percent of circuits with the highest number of outages per customer during major storms since July 1, 2012, and (2) the top ten percent of circuits with the longest outages due to major storms since July 1, 2012.[86] For a map of the CT grid edge communities click here: CT Grid Edge Communities.

DISCUSSION POINT

As indicated earlier, the program has not yet incentivized front of the meter batteries (a battery tied directly to the distribution or transmission system) and has focused to start on batteries located at buildings or behind the meter. Front of the meter batteries– while not directly benefiting building owners – can also provide valuable grid services – including providing back up power during storm events and the aforementioned peaking services. Towns will still see proposals like these, but on or near larger substations or transmission lines as the economics with stand-alone batteries (without state incentives) favor much larger projects that most likely can only tie into the transmission system.

STACKING INCENTIVES

As indicated earlier, state and federal incentives can also be stacked – meaning one can take advantage of multiple incentives on the same project. The different state incentives in NRES and SCEF cannot be stacked on top of each other but federal can be stacked on top of state. The maximum additional program benefit one can get in those programs is 20 % or 30 % in the case of carports. In most instances grants can be stacked on top of the state bid preference and federal tax incentives.

Potential Stacking Value of Projects Under 1 MW

Federal	Percentage
1. Starting ITC Bonus (assuming wage threshold met)	30%
2. Energy Community Bonus	10%
3. Low Income Project or Community Bonus	10% or 20%
4. Domestic Content Bonus	10%
Plus ITC applies to interconnection costs	
Potential Tax Credit or Direct Pay Value	60% to 70% of Project Costs
No Prevailing Wage or Apprenticeship Requirement	
State	
Favorable Pricing in NRES Middle Tranche	20% to 30% (Carports)
CT Low income/Landfill/Carport Bonus Pricing Preference	
Nonfinancial Benefits	
Local permitting (no CT Siting Council)	
Less stringent (less expensive) stormwater compliance	

For example, if a town has a smaller landfill or brownfield (5 acres or less of usable space) suitable for a 1 MW solar PV project, it could enter the landfill into the middle tranche of the NRES program with the per kWh pricing on the higher end. Plus, with this project the town would receive a 20% bid adder since a landfill or brownfield is involved. IRA's adder for brownfields could add another 10% savings on upfront project costs.

As this is a project under 5 MW, the interconnection costs will count towards the project's basis used to calculate the 30% to 40% ITC. Further, being a smaller project, an expensive utility group or transmission level study will most likely not be triggered by the application.

The project also would not be subject to either the federal or state prevailing wage and apprenticeship requirements, and all the permitting would be carried out at the local level, which can be a less expensive and faster process. Moreover, the stormwater compliance for a smaller project could be significantly less burdensome and costly depending on the town regulations.

By stacking the available incentives, lease prices or returns for towns in this scenario should be *significantly* higher - up to 3x to 4x more than on a site without these advantages.

GRANTS, RFPS AND OTHER RESOURCES

There are countless other federal and state programs that offer grant money, financial assistance, incentives for clean hydrogen, energy efficiency, demand response, etc. Further, DEEP, depending on the legislative mandates, can hold, and has held in the past, annual requests for proposals (RFPs) for solar PV, fuel cell, and offshore wind projects of a larger scale than offered in its two primary incentive programs. Based on its remaining authority granted under previous legislation DEEP is expected to hold another grid-scale RFP in 2023 or 2024, so towns should expect to see numerous large scale solar PV proposals, among others, soon thereafter.[87] DEEP also administers a microgrid grant loan program that has historically, largely been awarded to fuel cell projects and some solar PV/battery projects: Microgrid Grant and Loan Program. This program is not accepting any more applications currently. Another DEEP program that can be used for planning and development of local energy resilience initiatives is the DEEP Climate Resilience Fund.[88] Towns can apply for grants of up to $250,000 that will help with resilience planning along with grants up to $700,000 for project development that also leverages federal funding.

Given the relative prominence the fuel cell industry in the state, along with the clean hydrogen incentives in IRA, there are reports (Connecticut-Hydrogen-Task-Force-Study) and legislative proposals[89] to further incentivize clean or green[90] hydrogen fuel cells in the state. However, it is unlikely towns in Connecticut will see proposals regarding this aspect of fuel cell technology in the short term.[91]

The Connecticut Green Bank offers advice, some funding and direction to Connecticut municipalities through programs such as the Community Solutions program and in partnership with the state and the utilities through EnergizeCT. Further towns could consider the opportunities presented by SustainableCT.

While not a focus of this version of the guide, concurrently with greening the grid, towns should also be focused on the energy efficiency of their buildings and demand management (modifying the level and pattern of electrical usage). One could argue that the only true hope for achieving an emissions-free grid is through a combination of renewable energy projects along with reduced

demand or altered demand patterns – especially in light of the increased demand to come with widespread electric vehicle charging. There are numerous programs in the state that offer demand management services – in particular SmartBuildings CT – a UCONN administered program. For construction projects (including energy generation related ones) on schools, towns may also be eligible for grant money through this program: School Construction Grant Money.

At the federal level there are numerous funding and loan opportunities administered by the Department of Energy. There is also a specific program supporting projects that enable communities to use solar PV and solar PV plus storage to prevent disruptions in power caused by extreme weather events: RACER Funding Program. UCONN's Eversource Energy Center and its project to predict storm severity and potential impact on electricity distribution has been a grantee of these funds. IRA's climate and greenhouse gas-focused provisions also provide assistance to municipalities interested in developing solar PV and other energy resilience projects. It establishes a greenhouse gas reduction fund, which will be administered by the EPA to provide direct investments in technologies that reduce greenhouse gas emissions at the local level.[92] Although the details, which will be provided through EPA's rulemaking process, are not available yet, it is fairly clear that this money will be distributed through grants, loans, and financial assistance programs.[93] Further, the Federal Emergency Management Agency (FEMA) through both its Hazard Mitigation Grant Program (HMG) and its Building Resilient Infrastructure and Communities Program (BRIC) offers microgrid grants, and recently provided $10.2 million in planning funding for microgrant projects in Culebra and Vieques Puerto Rico.[94] The White House is also developing its Justice40 initiative the goal of which is to ensure that 40 % of the overall benefits of certain federal investments to do with, among other things, climate change, energy efficiency, clean energy and energy efficiency, flow to disadvantaged communities that are marginalized, underserved, and overburdened by pollution.

This is just a sample of some of the other state and federal opportunities that exist and could be considered by Connecticut municipalities. The object of this guide is simply to highlight the large number of incentives and opportunities for towns in Connecticut to enable them to move forward on local energy resilience. It is a unique time in terms of the amount of federal and state funding available for energy resilience projects at the municipal level in particular.

RECOMMENDATIONS

As indicated throughout, this guide is not meant to cover everything to do with local grid resiliency, but to provide more of a menu of the state and federal incentives that currently exist to spur localities into proactivity and to help them think more strategically. Some general recommendations are listed below:

1. Prioritize resiliency and micro-grids (i.e., fuel cells or solar PV coupled with batteries). Renewable energy by itself is not going to solve the climate change crisis so while various long-term solutions are being pursued, prepare for more storm-related outages and emergencies. The renewable energy transition will also take decades, so islanding and

microgrid capability for the most vulnerable buildings should take top priority, especially while incentive money is ample and available.

2. Think ahead and prepare for change and improvements. For instance, if one is only doing a rooftop solar project, pick an inverter that could potentially connect with a battery, and prepare all of the infrastructure for the eventual coupling of a battery. Do the infrastructure work (even the little things like putting in the conduit for the wire) now so major modifications are not required for future expansion, innovation, or the emergence of new technologies through different incentive programs.

3. If the project is in an area that sees reasonable traffic, and as long as one has the engineers and electricians onsite, add car charging stations. If the project is at a location where customers can afford to wait for several hours such as while at work or at school, think about level 2 chargers. In areas of high traffic where chargers are meant to act more like gas stations – think level 3 charging stations – which need to be the dominant level available if electric cars are to take over market share. There are significant federal and state incentives for car charging stations such as Electric Vehicles & Charging Stations | Eversource

4. Stack as many state and federal incentives on top of each other where you can. And do not wait. Incentives rarely improve over time and if there is a cap, the programs are often quickly oversubscribed.

5. Take advantage of the fact that Connecticut is a deregulated market and towns and others have a choice of electricity suppliers. There are numerous consultants that towns can work with to develop a sound procurement strategy to stabilize their energy costs while they are planning these energy resilience projects.

6. Understand the incentives developers are getting so you know what to ask from them. They are not going to do it for you and the state and federal regulators do not often mandate that the incentives trickle down to the towns. If they are getting more from the state programs or the federal tax incentives, some of it should flow downstream to the hosts/municipalities. And understand how scale matters and affects projects – large projects usually receive less money for the power they produce but can be cheaper to build, all of which can affect the benefits that might flow to the town.

7. Understand the tax laws and exemptions. Both personal property and real property taxes are applicable to most of these projects. Towns must balance attracting developers and projects to a community with getting their fair share. In other words, don't tax to penalize – be fair and be attractive to industry if local energy generation or storage is what a town wants.

8. Hire a good lawyer with experience in the industry (and consult with CIRCA). Often the leases or net metering/power purchase agreements associated with these projects are up to 35 years plus and are worthy of extra attention and industry expertise. Plus, the state laws

and rules and interpretations can change almost yearly making it almost impossible for those on the outside to navigate the programs and associated documents effectively.

9. Try and understand other industry challenges to become a better partner with private developers. For instance, inflationary pressures on panels can easily offset at times the benefits of federal and state incentives. Supply chain issues and long lead times on batteries can add to timelines of projects – at no fault of developers. Permitting can take longer than anticipated. As long as they are diligently and effectively moving forward, maintaining some level of flexibility can be key to a cooperative partnership.

10. Use less power at different times at town buildings; and utilize social media and other messaging to convince major energy users in your town to alter how and when they use power. Demand management is the cheapest and easiest way to reduce the stress on the grid, especially during storm events and peak periods. And it can also reduce one's demand and cap tag charges on the monthly power bill. Not enough attention is paid to the demand side of the equation – which can be as equally, if not more, effective a path towards reducing greenhouse gases as greening the grid – especially in the short run. The recent 4% to 5% drop in CO_2 emissions during the COVID-19 pandemic is a good example of this.[95]

Endnotes

(Hyperlinks are current as of publication)

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[1] 2022 U.S. billion-dollar weather and climate disasters in historical context | NOAA Climate.gov

[2] Sources of Greenhouse Gas Emissions | US EPA

[3] Backup Power: A Growing Need, if You Can Afford It - NYT

[4] Wind & solar is cheaper than oil & gas, now what? | Sustainable Review and PURA Docket 19-06-29

[5] Energy Justice | ABA

[6] CT DEEP Public Utilities Regulatory Authority Power Demand

[7] Why We Must Close Polluting Power Plants | U.S. News

[8] Peaker Power Plant Mapping Tool | Clean Energy Group

[9] The Peaker Problem | Clean Energy Group

[10] 2022-Clean--Renewable-Energy-Report.pdf (ct.gov)

[11] FirstLight Power to replace Connecticut peaker plant with 17MW battery energy storage system

[12] Electric Power Monthly | U.S. Energy Information Administration

[13] PURA 2022 Annual Report Exec Summary -FINAL (ct.gov)

[14] How States and Cities Can Benefit from Climate Investments in the Inflation Reduction Act | CAP

[15] Rhodium Group - A Congressional Climate Breakthrough

[16] 26 U.S.C. §§ 6417, 6418.

[17] Cities & the Inflation Reduction Act | Columbia Climate School Climate Law Blog

[18] Inflation Reduction Act: Clean Energy Project Liability for Local Governments | National League of Cities

[19] Legislative Analysis for Counties: The Inflation Reduction Act | National Association of Counties

[20] McGuire Woods - Inflation Reduction Act Extends and Modifies Tax Credits for Solar Projects

[21] Legislative Analysis for Counties: The Inflation Reduction Act | National Association of Counties

[22] Inflation Reduction Act and Renewable Energy Development: Its Advantages and Limitations | Reuters

[23] Impact of the Inflation Reduction Act of 2022 on Renewable Energy Tax Credits | Stinson

[24] Unless otherwise noted, all kilowatts or megawatts referred to in this Guide are in alternating current/ AC.

[25] The Inflation Reduction Act: Key Provisions Regarding the ITC and PTC | Foley

[26] Sidley Austin: IRS Sets Forth Higher Section 45 PTC Rate for 2022 Projects

[27] Impact of the Inflation Reduction Act of 2022 on Renewable Energy Tax Credits | Stinson

[28] An Overview of Clean Energy Tax Legislation in the Inflation Reduction Act | Moss Adams

[29] Impact of the Inflation Reduction Act of 2022 on Renewable Energy Tax Credits | Stinson

[30] Impact of the Inflation Reduction Act of 2022 on Renewable Energy Tax Credits | Stinson

[31] C.G.S. § 31-53

[32] 26 U.S.C. § 48(a)(12)

[33] 26 U.S.C.A. § 45(b)(9)(B)

[34] Notice 2023-38 | IRS

[35] Stoel Rives: Treasury Issues Preliminary Guidance on Domestic Content Bonus Credit Qualification

[36] Notice 2023-29 | IRS

[37] EPA Brownfields and Land Revitalization | EPA

[38] Connecticut Brownfields Inventory |DEEP

[39] Notice 2023-29 | IRS

[40] Sive Paget Riesel: Energy Community Guidance for Brownfields under the Inflation Reduction Act

[41] U.S. Dept. of the Treasury: Treasury, Energy Release Guidance on Energy Communities

[42] Generally defined as households with income of less than 200% of the poverty line (as defined in § 36B(d)(3)(A)) applicable to a family of the size involved, or less than 80% of area median gross income (as determined under § 142(d)(2)(B)).

[43] The Inflation Reduction Act: Key Provisions Regarding the ITC and PTC | Foley

[44] The Inflation Reduction Act: Key Provisions Regarding the ITC and PTC | Foley.

[45] The Inflation Reduction Act Will Turbocharge Energy Storage | Utility Dive

[46] Amazon 10kWh Battery for Sale

[47] Office of Energy Efficiency & Renewable Energy: Hydrogen Fuel Basics

[48] DOE: Fuel Cells Fact Sheet

[49] Office of Energy Efficiency & Renewable Energy: Fuel Cell Animation

[50] Bloom Energy: How Fuel Cells Reduce Carbon Emissions as Effectively As Renewables

[51] US EIA Capacity Factor Definition

[52] PVWatts Calculator (nrel.gov)

[53] Fuel Cells | Office of Energy Efficiency & Renewable Energy

[54] Washington Post - Clean Hydrogen Tax Stringent Rules/Opinion

[55] MWE: Clean Hydrogen Tax Benefits Under the Inflation Reduction Act

[56] Forbes: Green Hydrogen or Dirty Fuel? Treasury Department Rules Will Determine Industry's Future.

[57] SEIA Connecticut Solar Facts

[58] EIA: Hydrogen Explained.

[59] Non-Residential Renewable Energy Solutions Program | PURA

[60] Statewide Shared Clean Energy Facility (SCEF) Program | DEEP

[61] Electricity Plans

[62] Distressed Municipalities | CT.gov

[63] C.G.S. § 16-244z

[64] PURA Decision Regarding SCEFF Customer Allocation

[65] Public Act 19-35

[66] Operation Fuel

[67] Inflation Reduction Act and Renewable Energy Development: Its Advantages and Limitations | Reuters

[68] NYT: The U.S. Has Billions for Wind and Solar Projects. Good Luck Plugging Them In

[69] For purposes of this guide, utility or grid-scale means 5 MW or greater front-of-the meter.

[70] Eversource: NRES FAQs

[71] Eversource: Year 4 SCEF Program Manual

[72] See for example: PURA March 9, 2023 Letter Docket 22-08-03

[73] C.G.S. § 32-760

[74] WSJ - NYSE American Steel Index

[75] C.G.S. § 16-50i

[76] C.G.S. § 16-50k

[77] C.G.S. § 16-50k

[78] SCEF Modified Program Requirements | Eversource

[79] General Permit for the Discharge of Stormwater from Construction Activities | DEEP

[80] Public Act 21-53

[81] PURA Program Website

[82] Energy Storage Solutions Program Press Release

[83] Public Act No. 21-52

[84] Eversource, UI & Connecticut Green Bank launch next phase of energy storage program | Utility Dive

[85] Green Bank Press Release

[86] Energy Storage Solutions

[87] DEEP 2023 Procurements Amended Notice

[88] Climate Resilience Fund Program | DEEP

[89] See H.B. No. 6851

[90] National Grid: The hydrogen colour spectrum

[91] CNN: Biden administration sees hydrogen as a game-changing technology. The reality is more complicated

[92] Cities & the Inflation Reduction Act | Columbia Climate School Climate Law Blog

[93] Cities & the Inflation Reduction Act | Columbia Climate School Climate Law Blog

[94] FEMA Approves over $10.2 Million for Phase 1 of Solar Microgrids in Puerto Rico | FEMA

[95] NASA: Emission Reductions from Pandemic Had Unexpected Effects on Atmosphere