RESILIENT CONNECTICUT ANNUAL SUMMIT 2024
Breakout Session #2 – Municipal Energy Resilience

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CIRCA PRESENTATION

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Energy Resilience for Connecticut Municipalities

Text & Design by Christine O'Neill, Advised by Kirt Mayland

CT Public Act 20-5 defines resilience as "the ability to **prepare for and adapt to** changing conditions and **withstand and recover** rapidly from deliberate attacks, accidents or **naturally occurring threats or incidents**, including, but not limited to, threats or incidents associated with the **impacts of climate change.**"

What does this mean for towns?

Comprehensive energy planning for both government operations and the town as a whole is a necessity. Climate change is only one of the reasons this is important.

Goals of Resilience

- **Reliable**: Every time you turn the switch, the lights come on.
- **Sustainable**: The strategies you're using now will still work in 10, 25, or 50 years. This means not relying on non-renewable resources.
- **Affordable & accessible**: Everyone in the community should have access to power.
- **Mindful**: The energy sources we use should not be making climate change worse - that is self-defeating.

Strategies

- Distributed generation
  - Renewables
  - Microgrids
- Electrification
- Efficiency
- Storage
- Demand-Response

Resources

- Federal Grants for Resilience Activities
- EnergizeCT for Towns
- DOE's Efficiency-Resilience Nexus
- Resilient Power Planning Guide

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What does a good energy plan look like?

State: The State completed its latest Comprehensive Energy Strategy (CES) in 2018, and is currently working on its 2023 update.

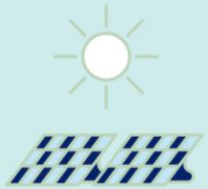
Large cities: Hartford's 2017 Climate Action Plan | New Britain's 2016 Energy & Innovation Roadmap for the Future | West Hartford's 2020 Energy Plan

Mid-size communities: Simsbury's 2019 Energy Plan | Middletown's 2019 Energy Plan | South Windsor's 2019 Municipal, Residential & Business Energy Plan

Small towns: Ashford Clean Energy Task Force's 2019 Municipal Action Plan

Distributed Generation: Renewables

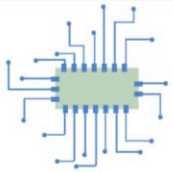
The electrical grid - the term we use for the network of cables, substations, and other infrastructure that deliver electricity - is outdated and overburdened, especially during windows of peak demand. To take some of the stress off the grid, municipalities should invest in creating their own power with renewables. These small operations that create energy in the same place it is being consumed (like a wind turbine on a farm or solar panels on a roof) are referred to as distributed generation.
Drawing electricity from the grid also means that power must travel long distances over cables, which are highly susceptible to being knocked down by winds or falling trees in storms. With climate change amplifying the frequency and intensity of such storms, towns are increasingly likely to face outages when reliant on the grid.
Renewables also have important co-benefits, like the fact that they are sustainable in the long term as opposed to non-renewable fossil fuels.



Distributed Generation: Microgrids

The U.S. Department of Energy defines microgrids as "a local energy grid with control capability, which means it can disconnect from the traditional grid and operate autonomously." The scale of a microgrid could be a few buildings, or an entire neighborhood. They are popular on university campuses (like the University of Bridgeport) or municipal complexes (like Fairfield, Woodbridge, and Milford).
In the climate change era, an energy source able to function independently of the grid is extremely valuable for municipal resilience. Cooling centers with charging stations can remain online during summer heatwaves - the municipal emergency operations center can remain up and running in blizzard. An added benefit is that microgrids tend to have opportunities for "smart grid" tech, such as the Wi-Fi connected thermostats or energy storage capabilities. Even if a microgrid only serves a small portion of your community, it removes strain and demand from the electrical grid, better allowing it to serve other residences and facilities.
Connecticut DEEP even has a Microgrid Grant & Loan Program to help you get started.

Electrification



New England is moving towards a decarbonized, more renewable-based grid, which is better for environmental and economic sustainability. In order to access these benefits, municipal buildings and vehicles should electrify. By continuing to use oil to heat a recreation center or gas-fired stoves in cafeterias, municipalities remain dependent upon harmful fossil fuels.
CT DEEP committed in their 2022-2024 Conservation and Load Management Plan to transition their Residential New Construction program into an all-electric offering, with their CHEAPR rebate making fleet electrification more affordable as well. Electrification also pairs perfectly with distributed generation and microgrids, as it allows facilities and fleets to subsist on energy produced at the source rather than on oil and gas delivered from other sources. With pipeline attacks making recent headlines, and it makes sense for municipalities to build resilience against such threats.

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Efficiency

Energy efficiency is the use of less energy to perform the same task or produce the same result. It is quite likely that your municipality has already engaged in some kind of efficiency measure - whether it was replacing CFL lightbulbs with LEDs, adding weather stripping to maintain indoor temperatures, or adding a fuel-efficient vehicle to the fleet. The U.S. Department of Energy describes efficiency as "one of the easiest and most cost-effective ways to combat climate change, reduce energy costs for consumers, and improve the competitiveness of U.S. businesses."
Because energy efficiency is in everyone's best interest, the State of Connecticut codified in Section 33 of Public Act 11-80 an Energy Conservation Management Board that assists electric utilities in providing incentives and programs to save energy. Energize CT is a vehicle for much of this work, in partnership with the CT DEEP and the Connecticut Green Bank. Before beginning work on public projects, it is well worth reaching out to these entities to understand if funding or guidance is available to your municipality.

Energy Star (ES) is the EPA-backed certification program for energy efficiency in appliances and technology. It can be an excellent tool in identifying upgrades to existing buildings from small scale (lightbulbs, computer monitors) to large scale (heating systems, data center equipment). For instance, switching from conventional phones to ES phones can result in 40% energy savings, while upgrading to ES ductless heat pumps can cut heating costs by 60% and cooling costs by 30%. The EPA's "Energy Efficiency in Local Government Operations" strategy guide contains excellent planning resources for crafting your own energy efficiency program.
Just like with any other commodity, the less energy you use, the smaller your bill is. Efficiency isn't just resilient - it makes economic sense.

Storage

Energy sources that can be deployed specifically when needed are referred to as "dispatchable." Oil, coal, natural gas, and nuclear are dispatchable; but wind and solar are not, instead called "intermittent." This becomes an issue when there is a mismatch between supply (no sun shining at night) and demand (subzero weather, where everyone has the heat running). The key to making these intermittent resources available when demand spikes is energy storage.
Energy storage allows ongoing power when an extreme weather event disconnects a facility from the grid. It is also a great way for municipalities to save money. When demand is high but supply is low, if you are on a peak pricing plan, your prices go up. Having a reserve of power to use at these critical times means municipalities can avoid peak pricing, while also reducing strain on the rest of the community's supply.
There are several types of storage including fuel cells and lithium-ion batteries. New technologies in this field are still emerging, and one of the most important areas of research is how to scale energy storage to accommodate more capacity.

Demand Response

Local energy resilience can also come from encouraging residents and businesses to lower their power usage during stressful times for the grid - such as hot, humid summer afternoons. This encouragement typically involves a utility increasing prices during these peak periods thereby discouraging power consumption.
Communications from the utility or even a municipality, often through social media, to its customers or residents has proven to be helpful in reducing consumption when it is the most needed. Municipalities could work with utilities on communicating with residents and local businesses in this regard similar to how they do with water companies and drought guidelines.

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There are numerous federal and state incentives for municipalities to implement these strategies. For more information, click here to contact CIRCA.

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Strategy for Better Local Energy Generation Projects

1

Follow the $$, Don't get too creative.

2

Think Microgrids (fuel cells or solar/batteries) if possible.

3

Understand the policies and why developers are where they are or what the town can do on its own

What is a Microgrid?

The U.S. DOE Microgrid Exchange Group defines a microgrid as “a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode.”

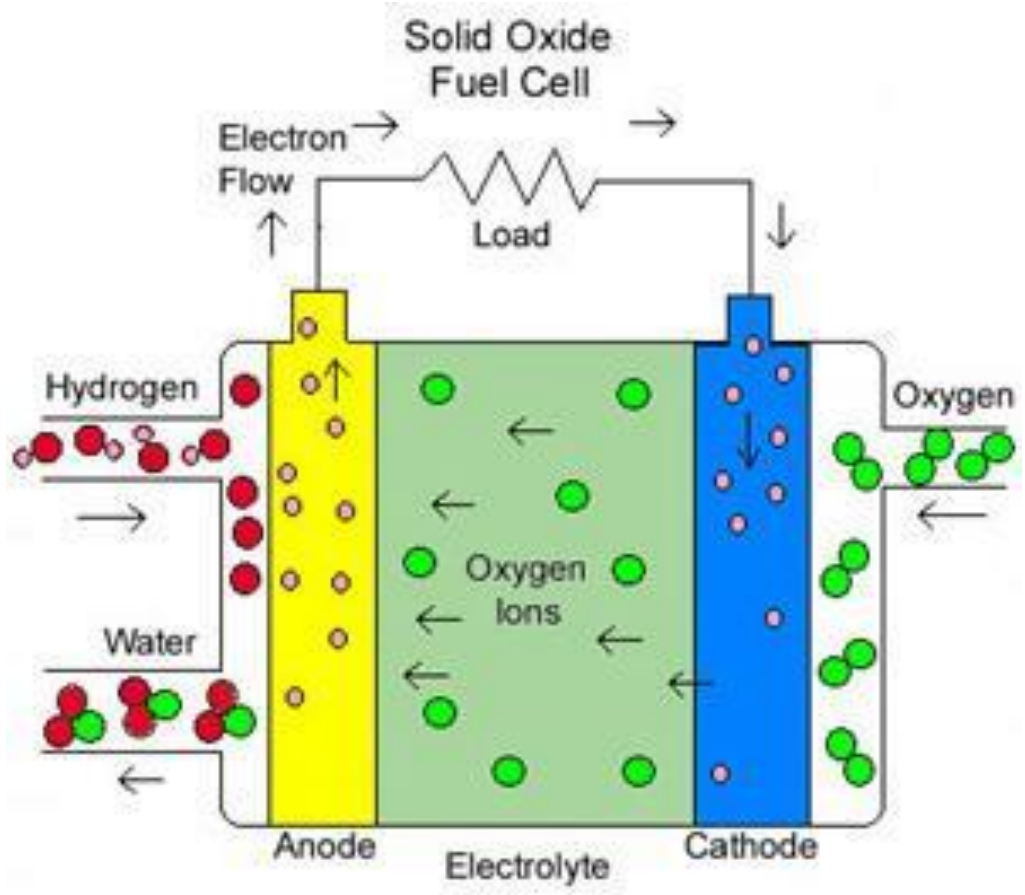
https://www.naseo.org/issues/electricity/microgrids

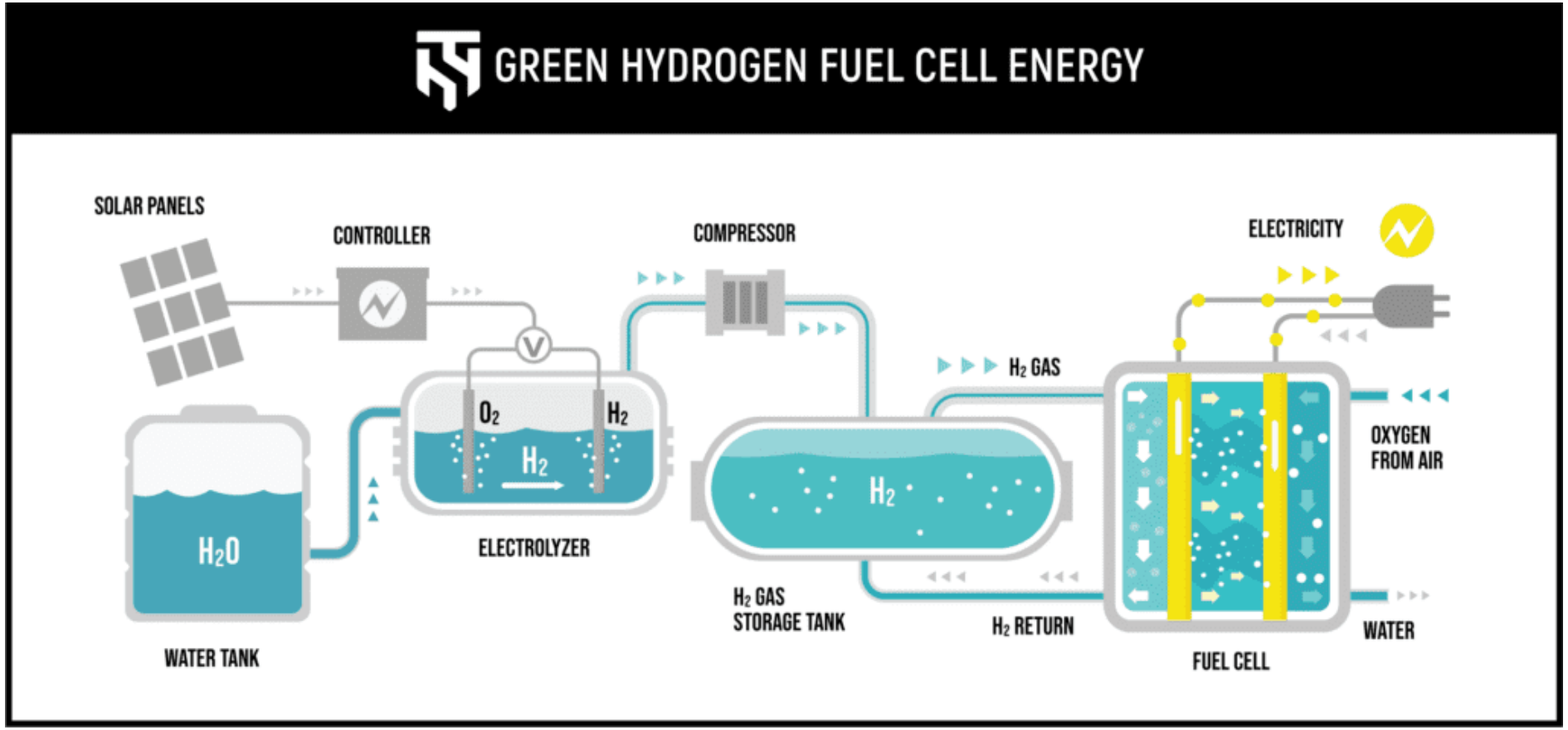
Benefits of a Microgrid

- **Resiliency** – Outage prevention
- **Save money** – Energy/operations/risk
- **Reliability** – Everyday availability
- **Sustainability** – More efficient, grid carbon intensity, complement renewables

How Fuel Cells Work

1. Hydrogen is fed to the anode, and air is fed to the cathode.
2. A catalyst at the anode separates hydrogen molecules into protons and electrons, which take different paths to the cathode.
3. The electrons go through an external circuit, creating a flow of electricity.




GREEN HYDROGEN FUEL CELL ENERGY
SOLAR PANELS
CONTROLLER
COMPRESSOR
ELECTRICITY
H_2 GAS
O_2
H_2
H_2
H_2O
ELECTROLYZER
H_2
OXYGEN FROM AIR
H_2 GAS STORAGE TANK
H_2 RETURN
WATER
WATER TANK
FUEL CELL

Benefits

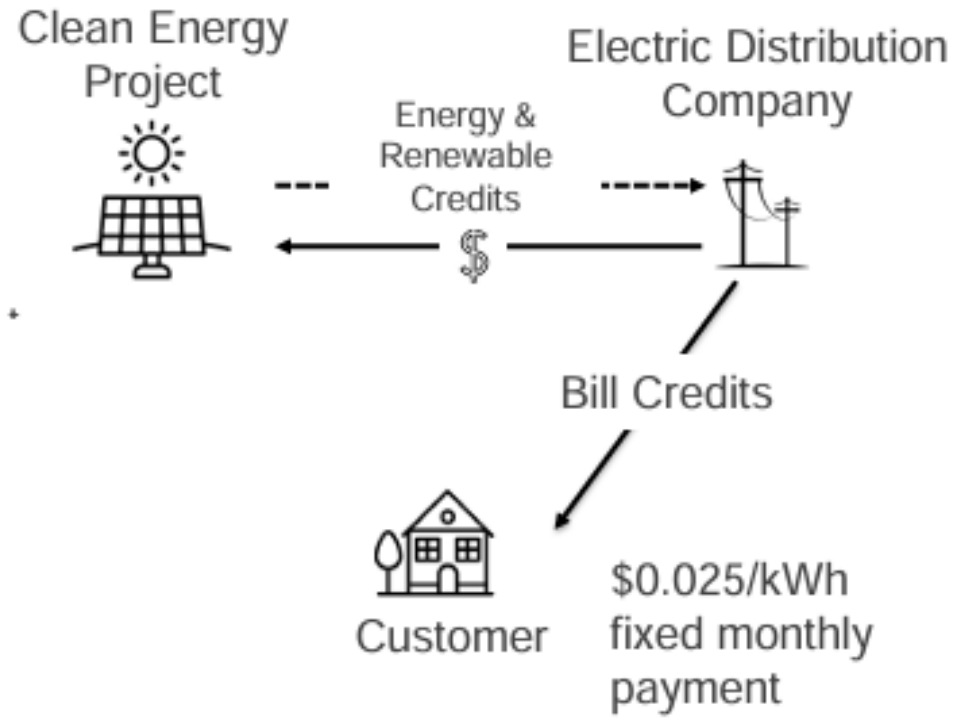
- Can show all-in savings vs. grid power
- Low maintenance
- Hedge against market prices
- Flexible sizing & applications
- Flexible grid arrangements: Grid parallel vs. Islanding
- Compatible with add on technologies (heat recovery, carbon capture, etc)
- Resiliency
- Reliability
- Sustainability

CT Solar/Fuel Cell Programs

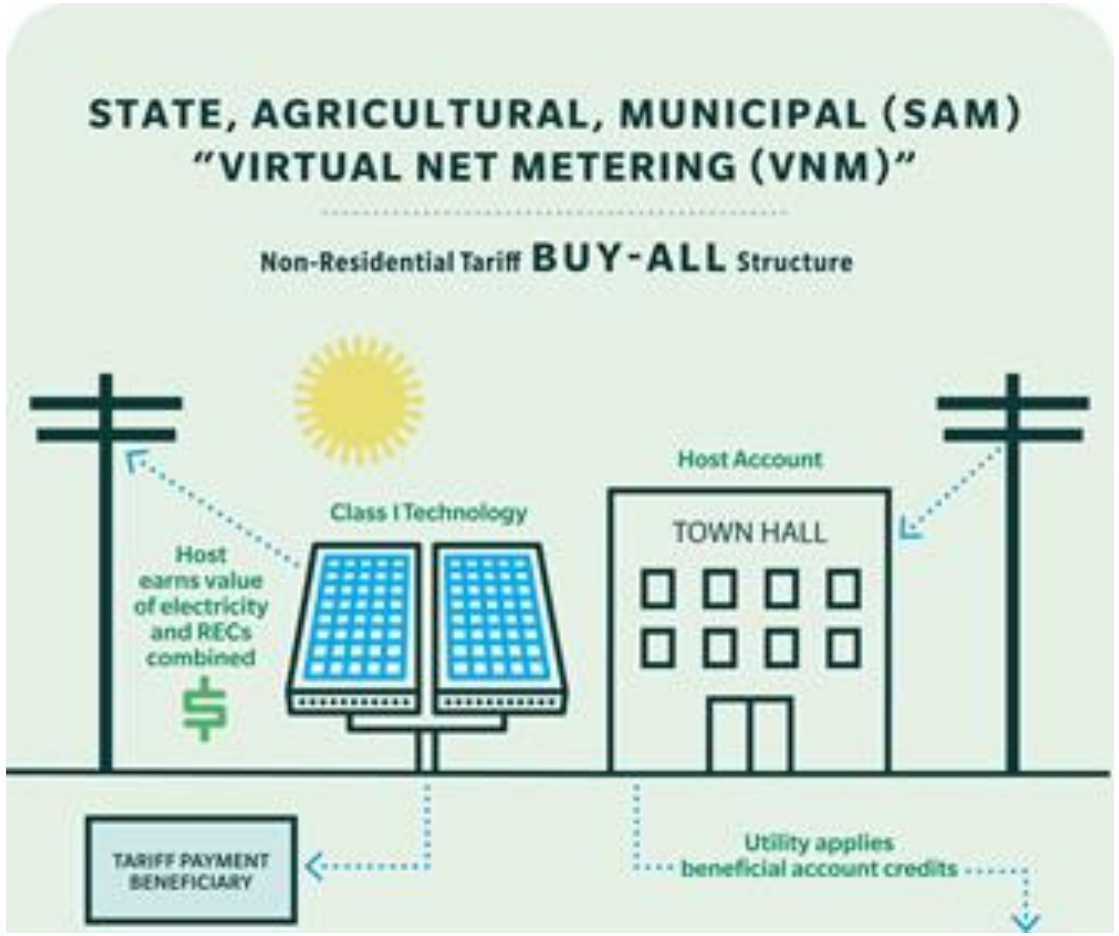
- *NRES* (solar and fuel cells)
  - Different tranches for fuel calls and solar
  - Behind the meter, and
  - VNM mandates projects on **municipal** (and state and ag) land/buildings
  - Favors projects located in **distressed municipalities, brownfields and landfills** (20%) and carports (30%) OR **where all the benefits flow there**
  - potential municipal benefits in terms of lease payments and electricity savings

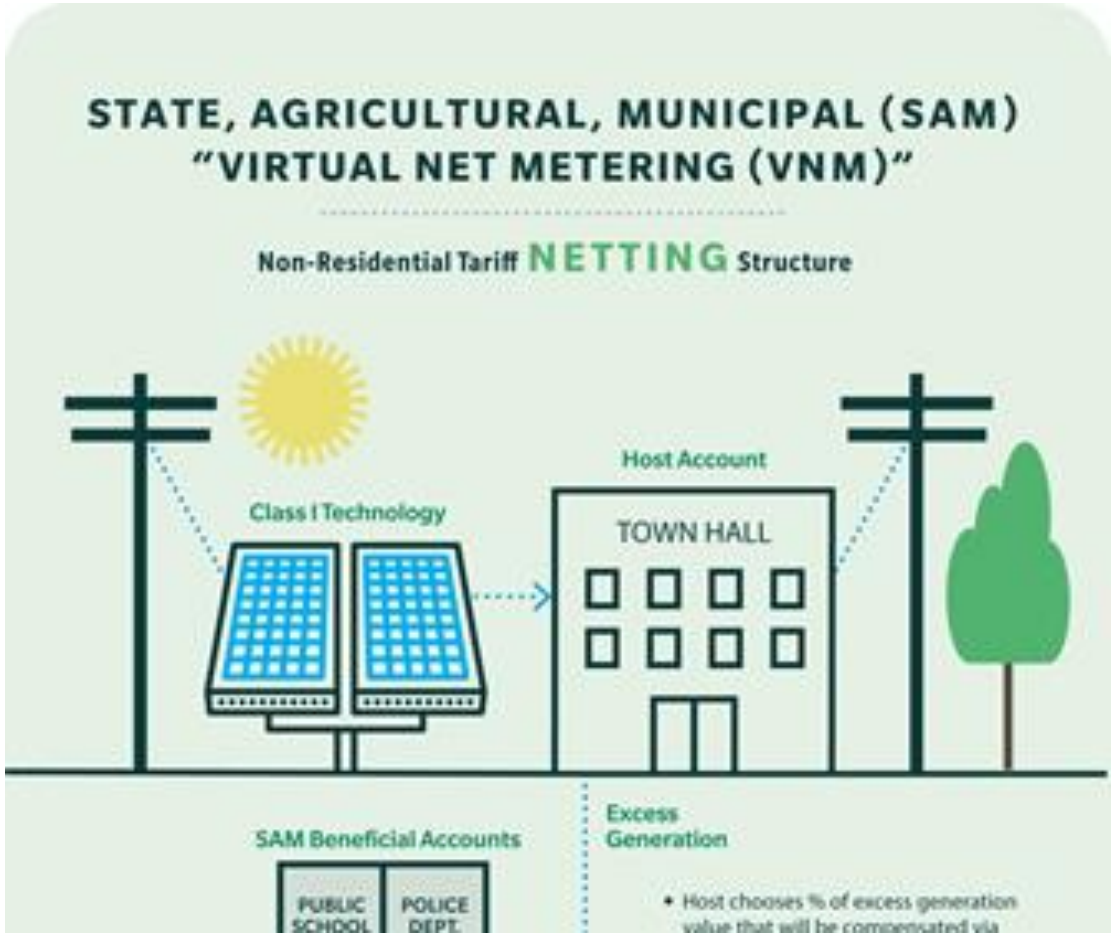
- *SCEF* (community solar – sort of)
  - **Low-income** customers
  - **Carports, canopies, brownfields and landfills**

SCEF


Clean Energy Project
Energy & Renewable Credits
Electric Distribution Company
$
Bill Credits
Customer
$0.025/kWh fixed monthly payment

SAM Virtual Benefits (NRES)





	NRES Virtual 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 offtakers only	
Siting incentives	Distressed municipalities (offtakers), brownfields, carports and landfills	Brownfields, carports and landfills

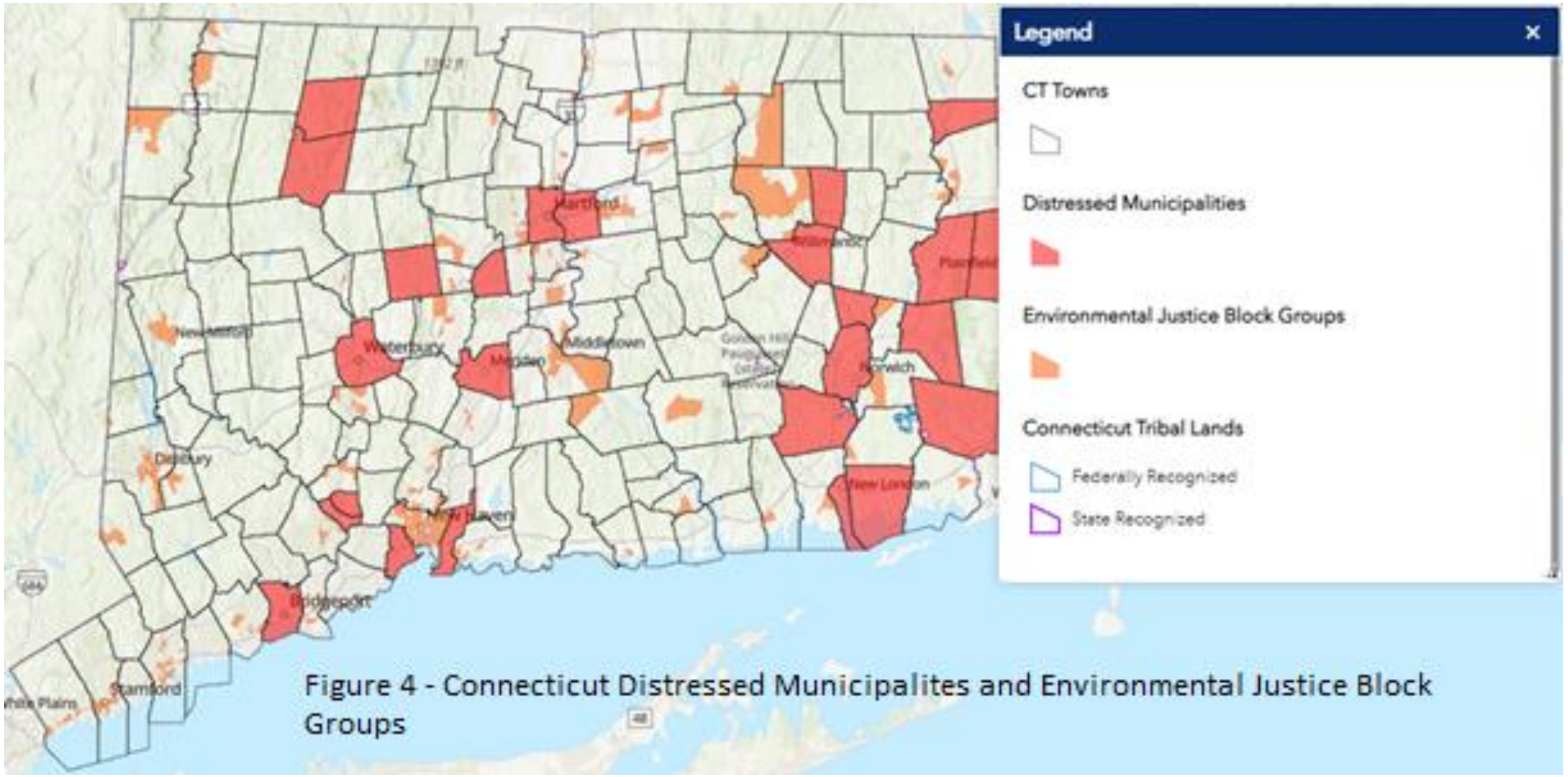


Figure 4 - Connecticut Distressed Municipalites and Environmental Justice Block Groups

2023 Distressed Municipalities - Alphabetical		
Municipality	**Score**	**Rank**
Ansonia	1,312	8
Bridgeport	1,283	12
Chaplin	1,188	21
Derby	1,299	10
East Hartford	1,318	5
East Haven	1,133	25
Griswold	1,360	2
Hartford	1,348	3
Lisbon	1,202	18
Mansfield	1,230	16
Meriden	1,198	20
Montville	1,183	22
New Britain	1,269	13
New London	1,347	4
Norwich	1,313	7
Plymouth	1,199	19
Putnam	1,252	14
Sprague	1,287	11
Sterling	1,246	15
Torrington	1,316	6
Voluntown	1,170	24
Waterbury	1,302	9
West Haven	1,180	23
Winchester	1,224	17
Windham	1,454	1

Battery Storage

CT Energy Storage Solutions

Table 4: Commercial and Industrial Upfront Incentives (2022-2024)[8]

Installed Capacity (MW)	Small Commercial ($/kWh)	Large Commercial ($/kWh)	Industrial ($/kWh)
50	$200	$175	$100

- Limited space
- Capped at 50% project cost

Upfront Rebate

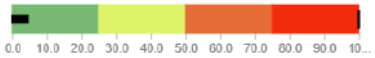
C&I Current Tranche is: 2

C&I MW Approved and Capacity Remaining

4.4

MW Capacity Limit: 100.0 (+95.61%)

C&I MW Approved Progress to Capacity Limit



https://energystoragect.com/ess-performance-report/

Table 5: Performance-Based Incentives (All Customer Classes 2022-2024)

Years 1-5		Years 6-10	
Summer ($/kW)	Winter ($/kW)	Summer ($/kW)	Winter ($/kW)
$200	$25	$115	$15
$225 annual		$130 annual	

Ongoing Performance Revenue

Upfront rebate generally 10-20% of project cost. Stacks on top of federal ITC benefits.

Ongoing Performance Revenue "Connected Solutions" is the primary/largest value stream over the battery's lifespan.

Why Battery Storage?

Savings Opportunity

- On-Bill Savings
  - Capacity tag reduction
  - Demand charge management
- Cashflow positive

Backup power

- Provides short term backup power
- Allows for seamless power transition in the event a grid outage occurs

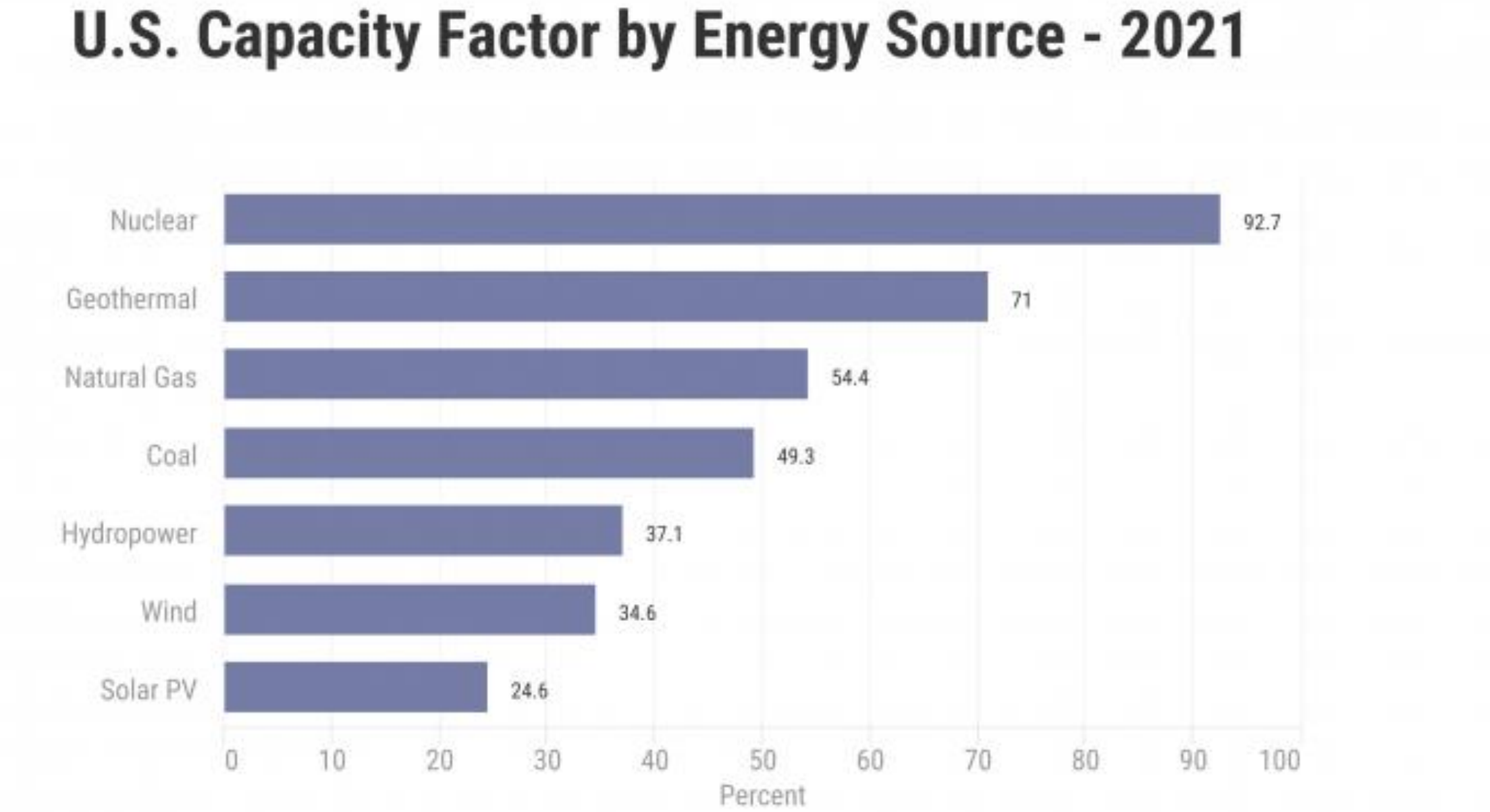
Supports Renewables and Resiliency

- Implementation of renewable energy systems
- Reliability and resiliency of the grid
- Decrease regional emissions

Renewable Energy: Obstacles in Connecticut

What is Capacity?

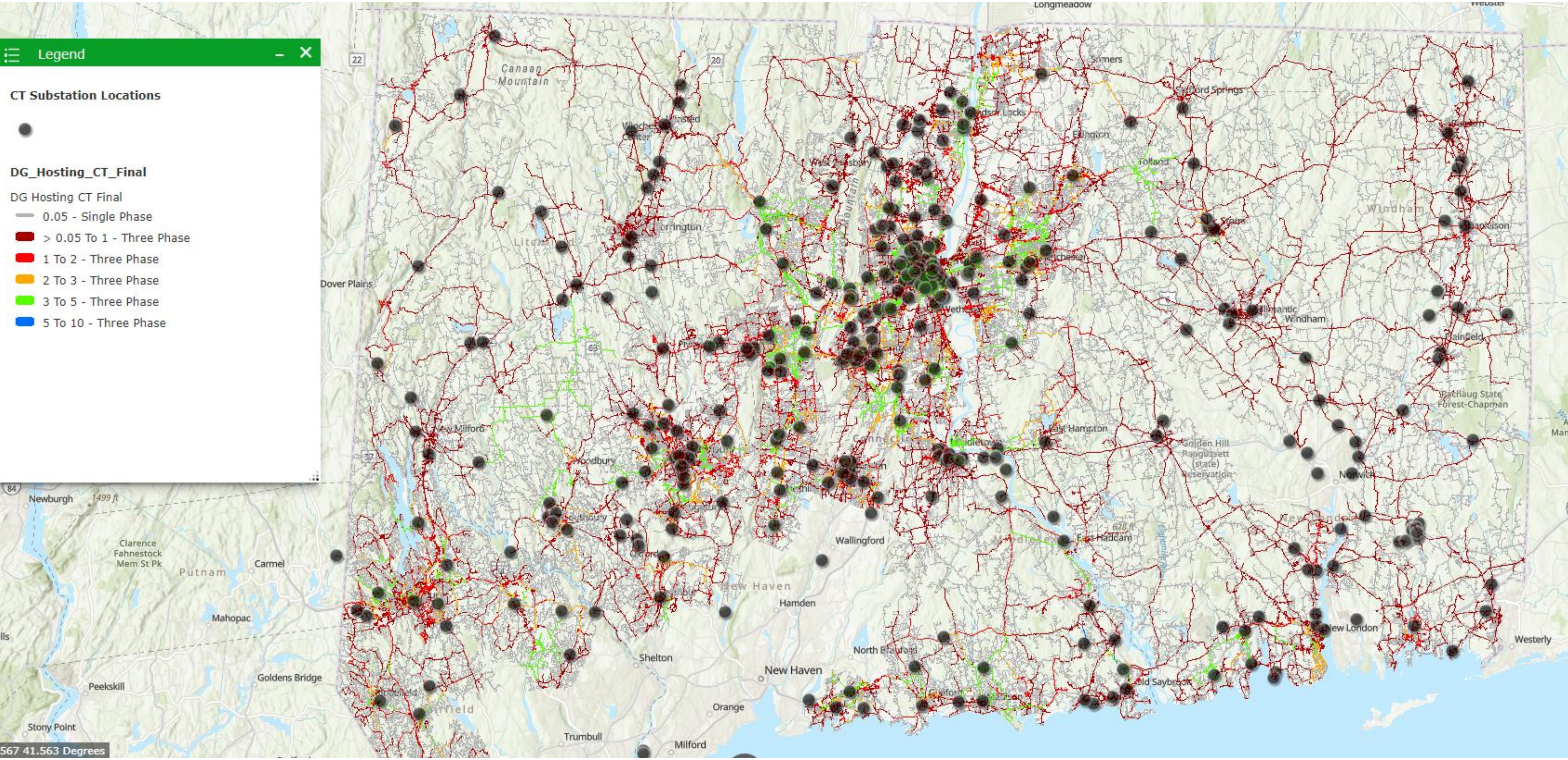
Capacity is the amount of electricity a generator can produce when it’s running at full blast

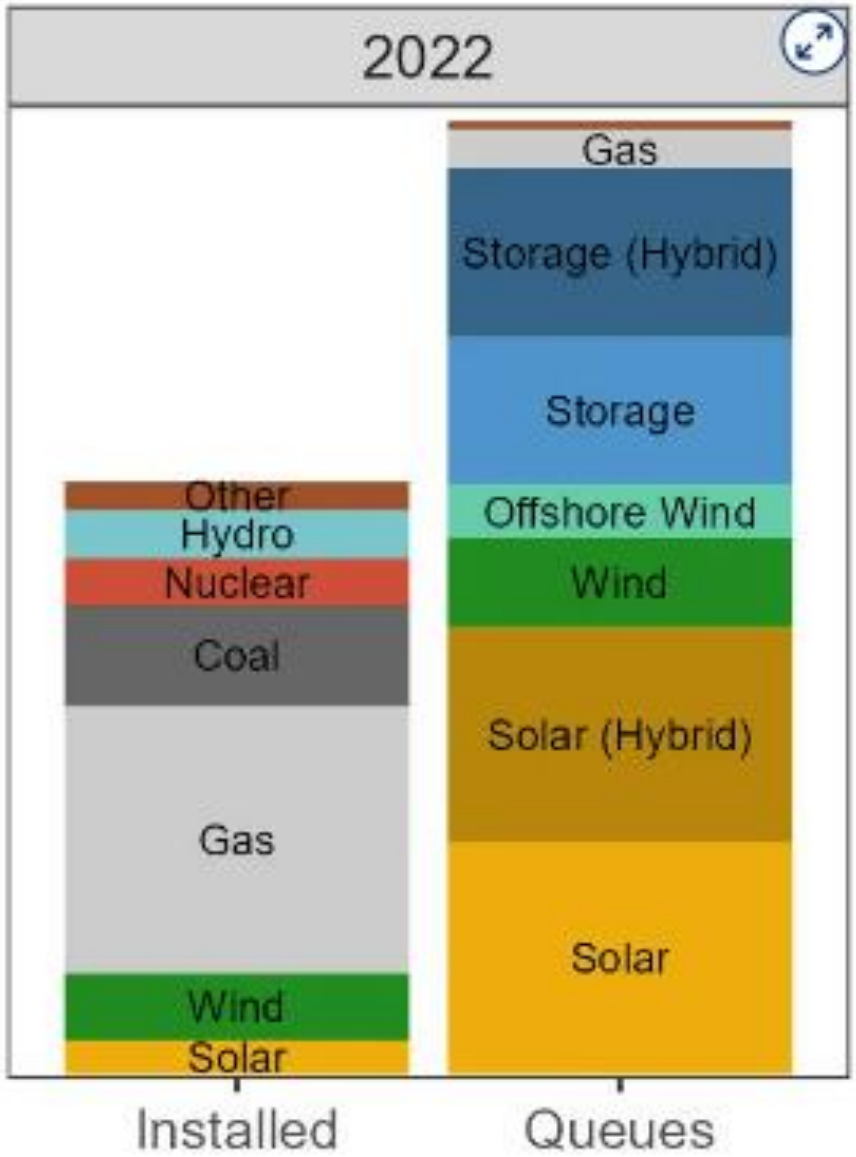


- Fuel Cells: 95%
- Wind: 25%

Solar Example - 1 MW in Connecticut						
<u>How much power actually produced:</u>					1,250,000	kWh
365 days x 24hours x (nameplate capacity or 1 MW or 1000 kW)				equals	8,760,000.00	kWh
Capacity =	14%					

Eversource Host Capacity Map


Legend
CT Substation Locations
DG_Hosting_CT_Final
DG Hosting CT Final
0.05 - Single Phase
> 0.05 To 1 - Three Phase
1 To 2 - Three Phase
2 To 3 - Three Phase
3 To 5 - Three Phase
5 To 10 - Three Phase
Longmeadow
Webster
Canaan Mountain
Somers
Ellington
Tolland
Windham
Dover Plains
New Milford
Woodbury
East Hampton
Norwich
Newburgh
Clarence Fahnestock Mem St Pk
Putnam
Carmel
Mahopac
Wallingford
Hamden
New Haven
Shelton
North Branford
East Haddam
New London
Westerly
Old Saybrook
Peekskill
Goldens Bridge
Stony Point
Orange
Trumbull
Milford
567 41.563 Degrees



CLEAN ENERGY

Wind and solar power generators wait in yearslong lines to put clean electricity on the grid, then face huge interconnection fees they can’t afford

PUBLISHED THU, APR 6 2023•9:00 AM EDT

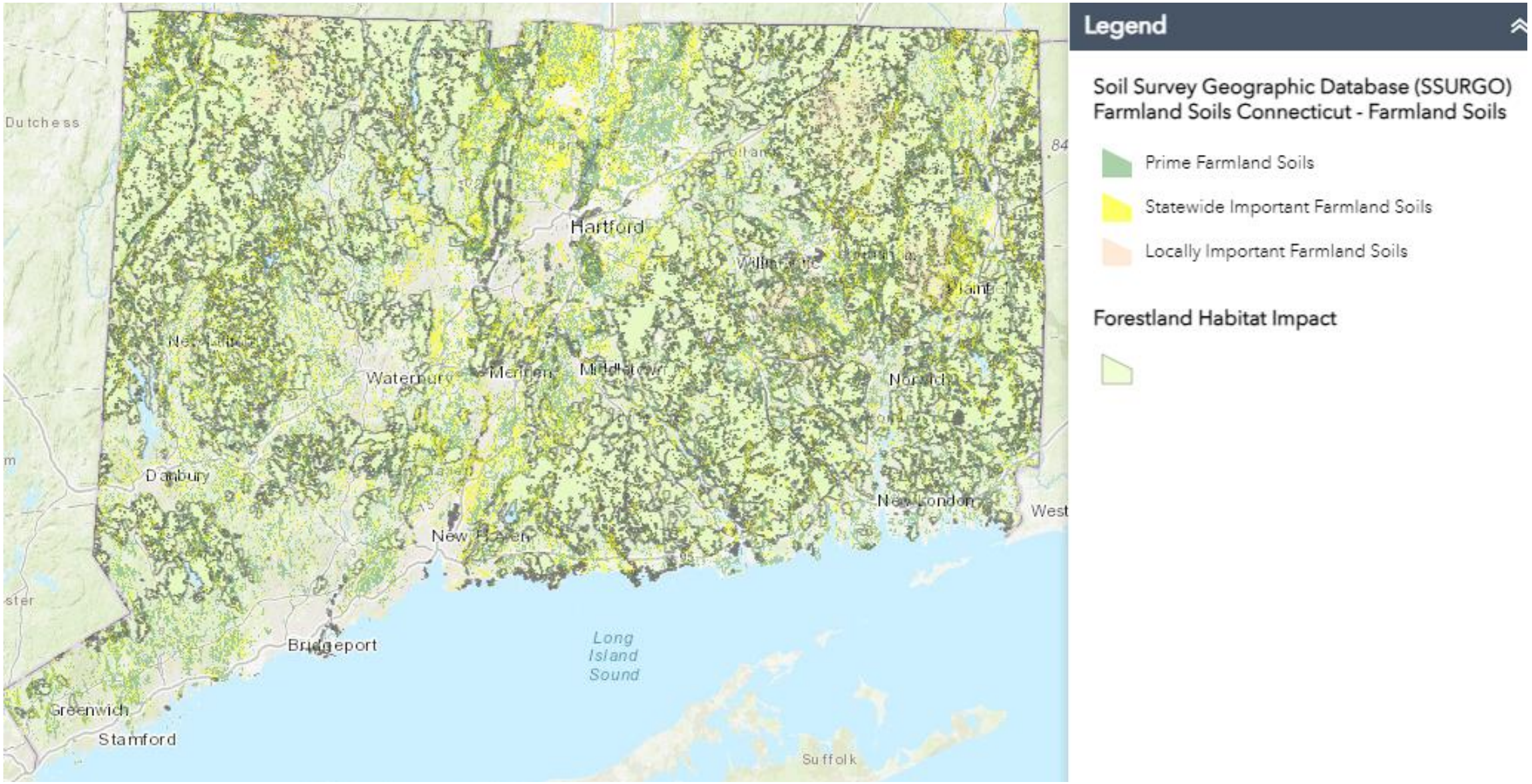
Catherine Clifford
@IN/CATCLIFFORD/
@CATCLIFFORD

Environmental Priorities — Solar Energy and Land Conservation — Compete in the Legislature

— Brendan Crowley, 1.29.2021

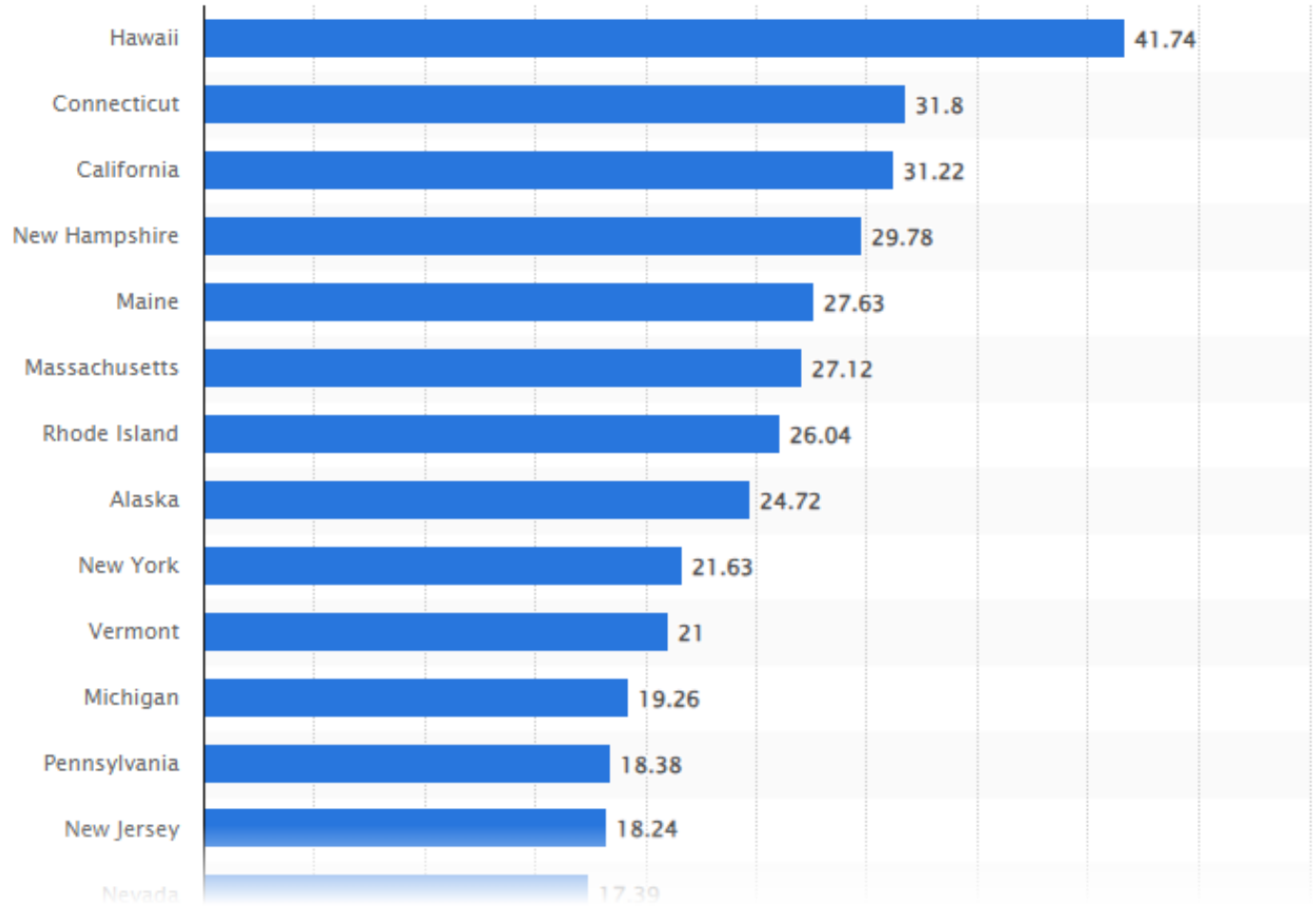
Core Forest and Prime Farmland Soils and Slopes

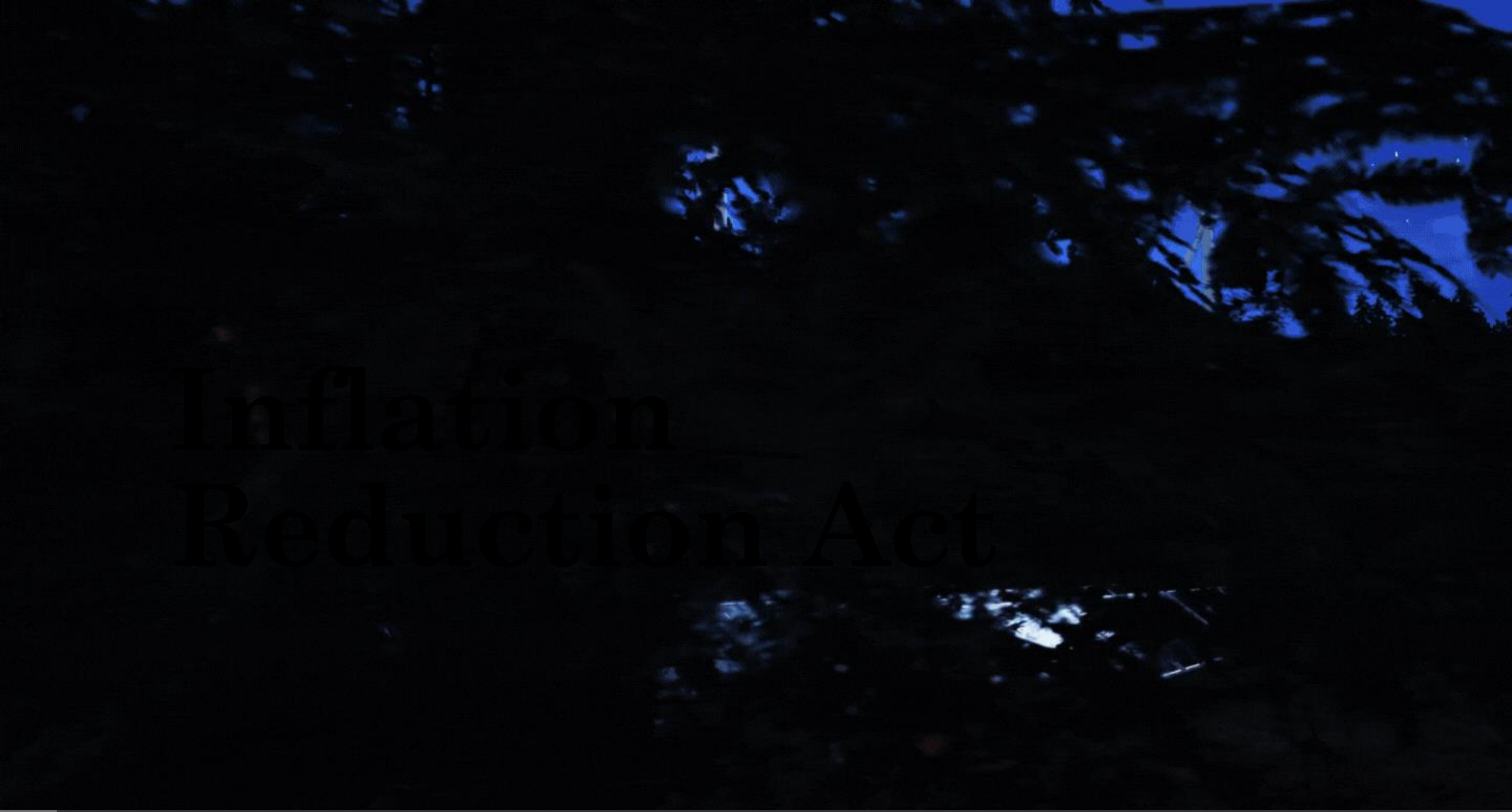
- Anything over 2 MW- disfavored to be in these areas
- Anything over 15 degrees slope not allowed (sort of)


Legend
Soil Survey Geographic Database (SSURGO)
Farmland Soils Connecticut - Farmland Soils
Prime Farmland Soils
Statewide Important Farmland Soils
Locally Important Farmland Soils
Forestland Habitat Impact
Dutchess
Hartford
Waterbury
Meriden
Middletown
Norwich
Danbury
New London
New Haven
Bridgeport
Long Island Sound
Greenwich
Stamford
Suffolk

Average residential sector retail electricity price in the United States as of May 202 state

(in U.S. cents per kilowatt-hour)




Inflation
Reduction Act

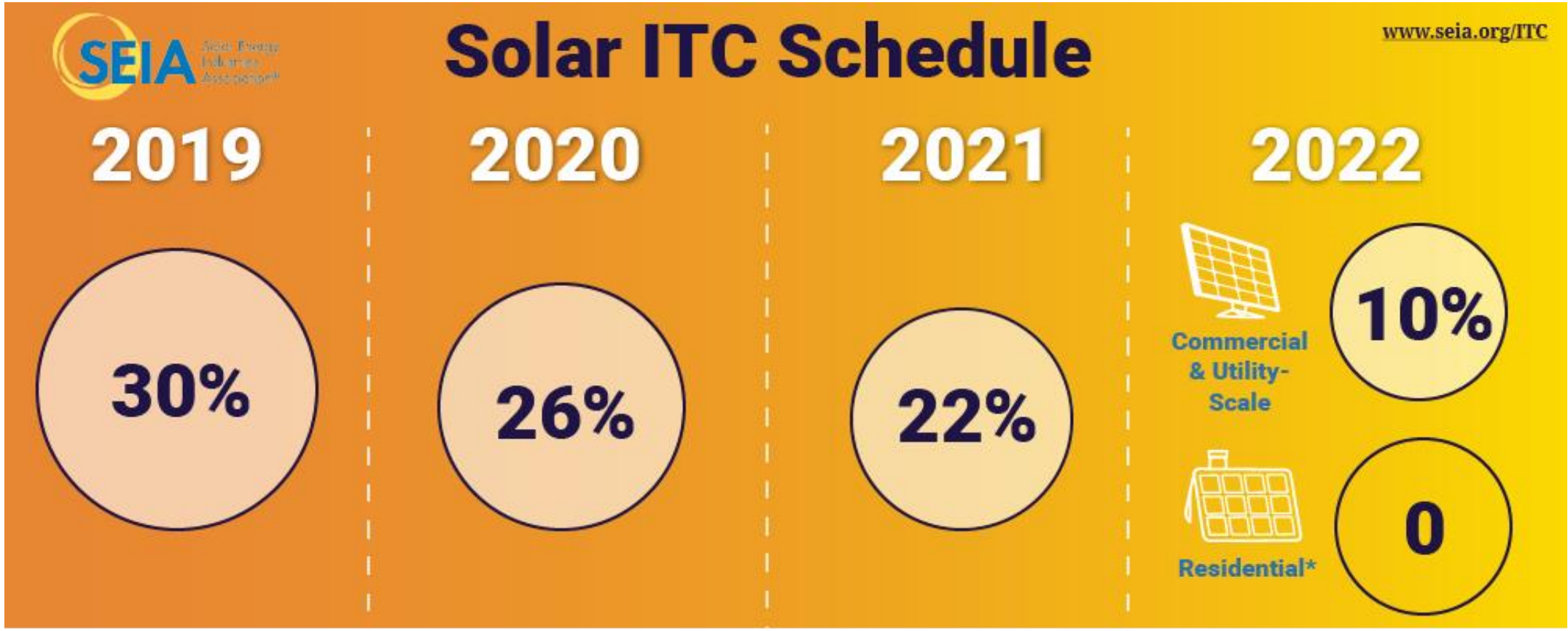
Inflation Reduction Act

Summary of immediate changes to commercial tax credits

Changes slated to take effect in 2023, subject to further IRS guidance:

1. 10 Years
2. Transferability and Direct Pay
3. Storage ITC
4. Interconnection Costs
5. Prevailing Wage and Apprenticeship Requirements
6. ITC bonus for domestic content, brownfield sites, and low-income projects
7. PTC

Federal Tax Credits (Briefly)



*Some residential solar systems are financed using a lease mechanism that allows the homeowner to take advantage of the Section 48 commercial ITC

How do Credits Work?

Income Tax Credit

- $1,000,000 cost of construction
- $300,000 tax credit (assuming 30%)
- Sell this and the depreciation to a big taxpayer for cash

Production Tax Credit

- Based off of production – not cost of construction
- Get it every year for 10 years

Starting in 2023 – Direct Pay for Towns to Monetize Credits

- Receive cash for credits through IRS refund process (AT COD)
- Eligible entities: tax-exempt entities, rural electric co-ops, and states/munis
- Eligible entities cannot transfer
- Fine print … “domestic content” stick

Energy Storage ITC

Stand-alone ITC without any obligation to charge with renewable power

Broad definition: "property . . . which receives, stores, and delivers energy for conversion to electricity . . . and has a nameplate capacity of not less than 5 kilowatt hours"

- Would include pumped-hydro storage

Residential credit available provided battery has at least 3 KWh of capacity

Interconnection Costs

For projects up to 5 MW (AC) in capacity, interconnection costs are eligible for ITC

Includes upgrades and facilities owned by the utility

Applies to energy storage facilities and all other facilities that qualify for the ITC

Cannot claim PTC on interconnection costs

Single-plant risks?

Transmission ITC did not make it into the bill

Bonus ITC: Domestic Content

- Certify that any steel, iron, or manufactured products was produced in the US
- Steel and Iron: Must be 100% US, applied consistent with Buy American Act regs:
- Manufactured Products: Deemed US made if "*adjusted percentage*" of the total cost of products and subcomponents "are mined, produced, or manufactured in the United States"

CONSTRUCTION BEGINS	ADJUSTED PERCENTAGE
Before 2025	40%
In 2025	45%
In 2026	50%
In 2027 or later	55%

Bonus ITC: Energy Communities

Includes (i) "brownfield sites," (ii) census tracts with shuttered coal mines/generation, and (iii) areas with high unemployment and a fossil-fuel industry presence.	Incorporates the brownfield site definition from CERCLA:	Be mindful of brownfield exclusions under CERCLA which include:
	• "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."	• Superfund sites (listed or proposed for listing); • Sites subject to court orders, consent decrees, or admin orders; and • Sites subject to certain permits, e.g., RCRA, TSCA, and the Safe Drinking Water Act.

Legend

Coal Closure Energy Communities

	Census tract with a coal closure
	Directly adjoins a tract with a coal closure
	Meets the Fossil Fuel Employment Threshold

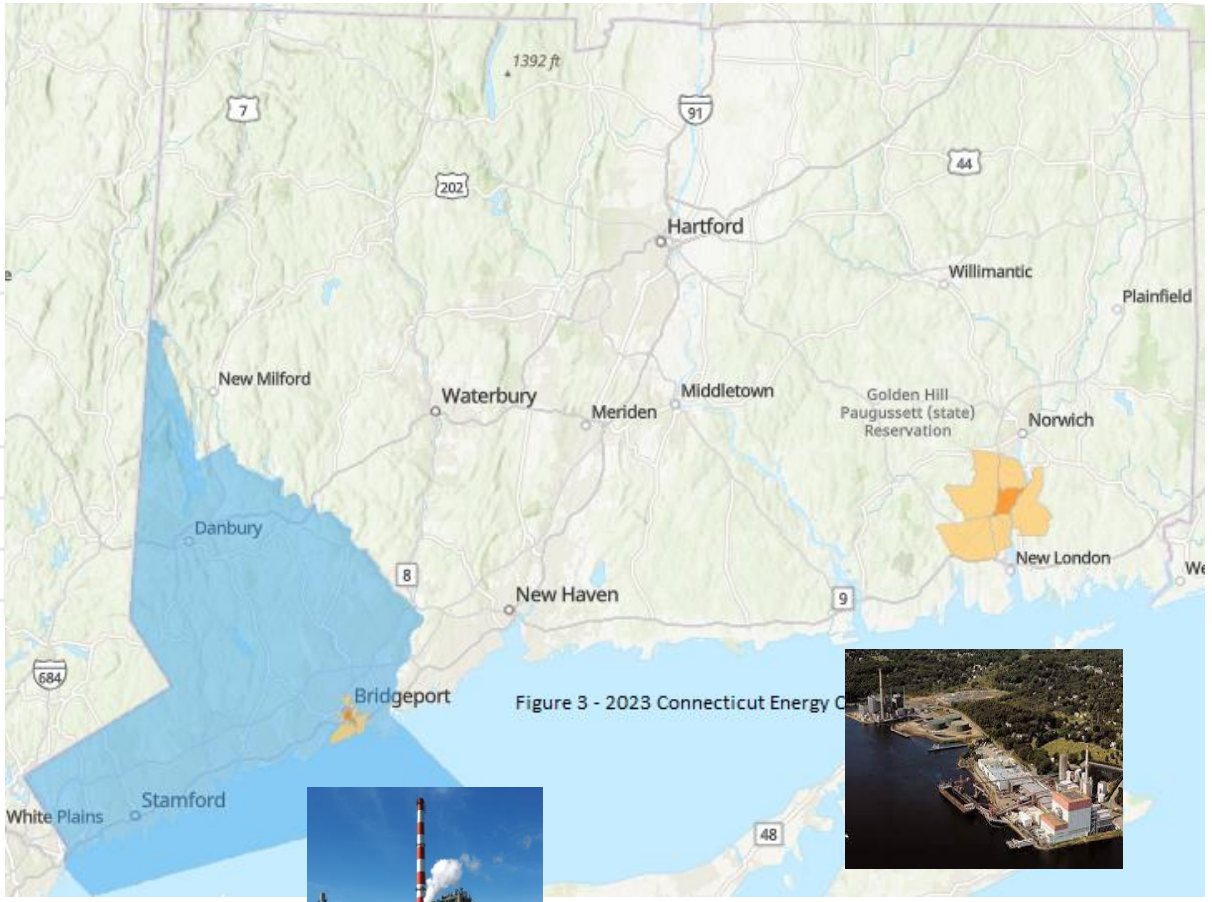


Figure 3 - 2023 Connecticut Energy C

Bonus ITC: Low-Income Solar and Wind Projects

General Restrictions

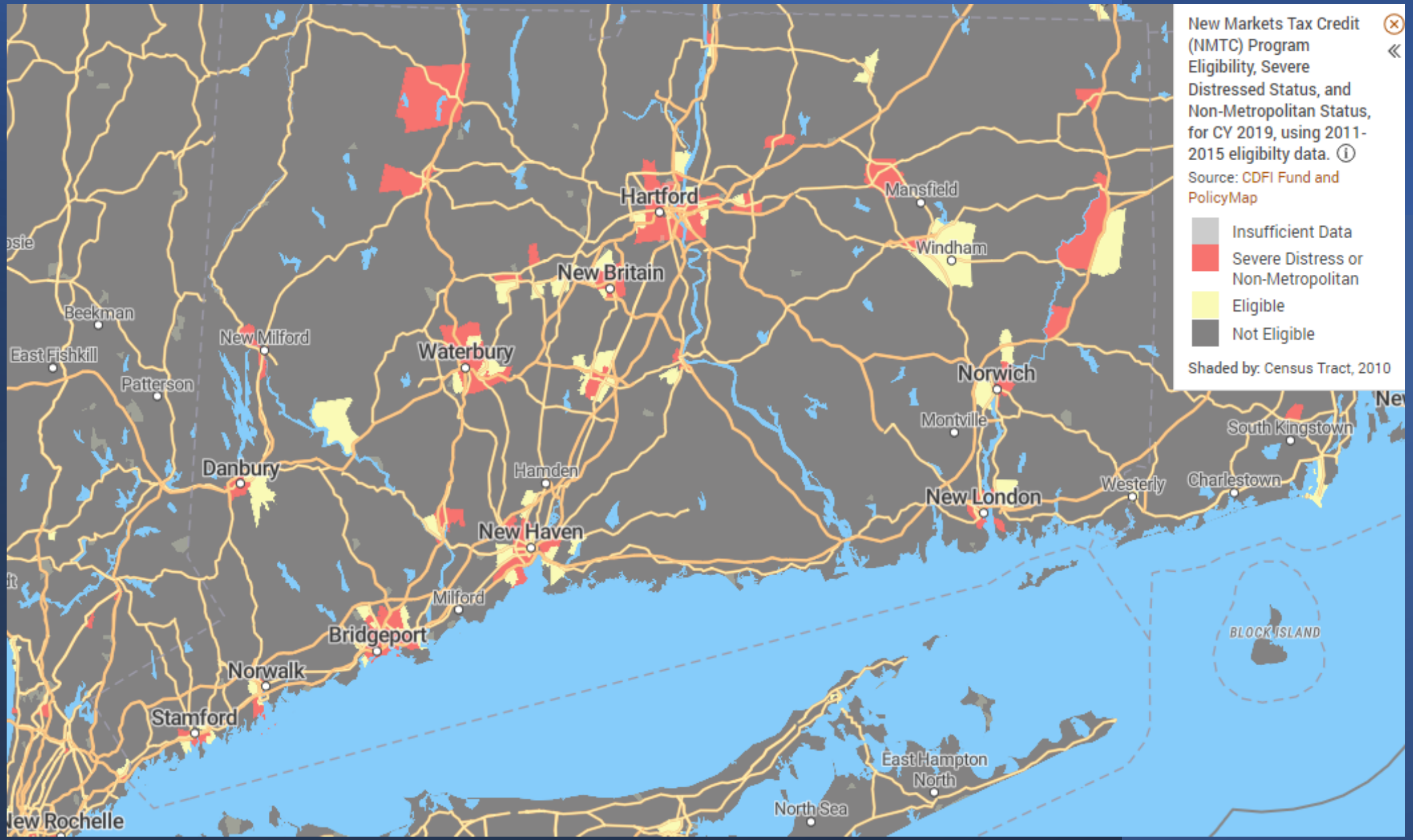
Application>Award
1,800 MW (DC)/year
Under 5 MW (AC)
Only solar or wind, and integrated storage
No PTC bonus

Low-Income Project

20% bonus – 2 Types
Installed on affordable housing AND tenants receive financial benefits.
At least 50% of financial benefits provided to low-income households

Low-Income Site

10% bonus
Located in a "low-income community"
Relies on NMTC mapping


New Markets Tax Credit (NMTC) Program Eligibility, Severe Distressed Status, and Non-Metropolitan Status, for CY 2019, using 2011-2015 eligibilty data.
Source: CDFI Fund and PolicyMap
Insufficient Data
Severe Distress or Non-Metropolitan
Eligible
Not Eligible
Shaded by: Census Tract, 2010
Hartford
Mansfield
Windham
New Britain
Waterbury
Beekman
East Fishkill
New Milford
Patterson
Danbury
Hamden
New Haven
Milford
Bridgeport
Norwalk
Stamford
New Rochelle
Norwich
Montville
New London
Westerly
Charlestown
South Kingstown
BLOCK ISLAND
East Hampton North
North Sea

	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		


The End