

# A Carbon Neutrality Path for Stonington

A Report Submitted to the Town of Stonington from the collaboration with the University of Connecticut and the Connecticut Sea Grant Program, UConn Center for Land Use Education and Research, and Department of Extension

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## Introduction

During the Spring Semester of 2021 the University of Connecticut, in coordination with the Town of Stonington, agreed to have undergraduate students from the Storrs campus conduct an independent study. In our first meeting with the Town of Stonington on (1/26/2021), including Planning Director Keith Byrnes and Climate Change Task Force Chair Rick Newton, our group was tasked with presenting potential options the municipality could prioritize to reduce its environmental impact. Over the course of that time the members of the group have been reviewing neighboring municipalities strategies, alternative energy technologies, and continued monitoring the national discussion on climate change.

Through this independent study our team has produced recommended actions that would help reduce Stonington's impact on the environment. Considering the scope of the work and the range of potential pathways for sustainability, we first focused on designating what options would have the largest impact.

In 2014 the International Panel on Climate Change (IPCC) released its *Fifth Assessment Report* which details a multidisciplinary effort to source the causation of climate change and assess the necessary steps needed to reduce its impact. In a follow-up 2018 publication titled *Global Warming of 1.5°C an IPCC Special Report* the working group established that to avoid the worst effects of climate change, global warming must be limited to no more than 1.5°C before [pre-industrial levels](#). This special report builds upon the subsequent research of the 2014 report which found that increasing greenhouse gas emissions (GHG) are the driving force behind atmospheric warming. Of the GHG's contribution to climate change, CO2 emissions account for 78% of increased emissions from 1970 to 2010 with similar percentage contributions for the 2000-2010 period.

Considering the broad acceptance of this report by signatory nations through the Paris Climate Agreement, our group concluded that the best effort for reducing Stonington's overall impact on the environment would be best achieved through aggressive carbon reduction strategies. Due to this the context of the report focuses on reducing carbon emissions in Stonington both directly through renewable technologies and indirectly through municipality sponsored programs.

Understanding that the charge from Stonington was to focus on strategies that had proven success in other municipalities, commercial adaptability, and long term economic viability, we present the following sections. The carbon reduction strategies will be categorized as either *direct reductions* or *indirect reductions*. *Direct reductions* categorize all the recommended renewable technologies that would produce clean energy and replace carbon-based infrastructure. *Indirect reductions* are broader, municipality directed mechanisms in the community that prioritize sustainability efforts. These sections are of course not inclusive of all the renewable technologies available but are to the best available knowledge the most commercially viable for the Town of Stonington, primarily in cost and effectiveness.

## **Background Research**

As stated in the previous section the focus of this independent study will be on avenues Stonington may pursue that directly or indirectly reduce its carbon emissions.

Presenting the direct carbon reduction strategies also corresponds with Stonington's ask for our group to present options that the municipality could act on. Accordingly, direct carbon reductions would present an opportunity for the municipality to prioritize retrofitting government owned buildings with renewable generation technology. By pursuing this option Stonington could leverage its properties such as the municipal town hall, schools, and all underutilized public lands to produce clean energy. All the contextualized recommendations are based on successful implementations in Connecticut and New York. We will focus on renewable energy through solar and geothermal.

The section of indirect carbon emissions focuses on strategies that the municipality may take to reduce its carbon footprint through strategies that engage community participation. Many of the options we present for this type of carbon reduction are based on programs that have improved effects on sustainability. Although such programs do not directly subsidize a replacement for current carbon emitting infrastructure, they do promote environmentally positive activities and characteristics which progressively assist sustainability efforts. Since such activities are wide-ranging, we will present the ones that we have seen successfully adopted in other municipalities. We will focus on electric vehicle fleet conversions, community composting,

energy efficiency strategies, and potential clean energy buy in options that have been implemented in other states and are currently being lobbied for here in Connecticut.

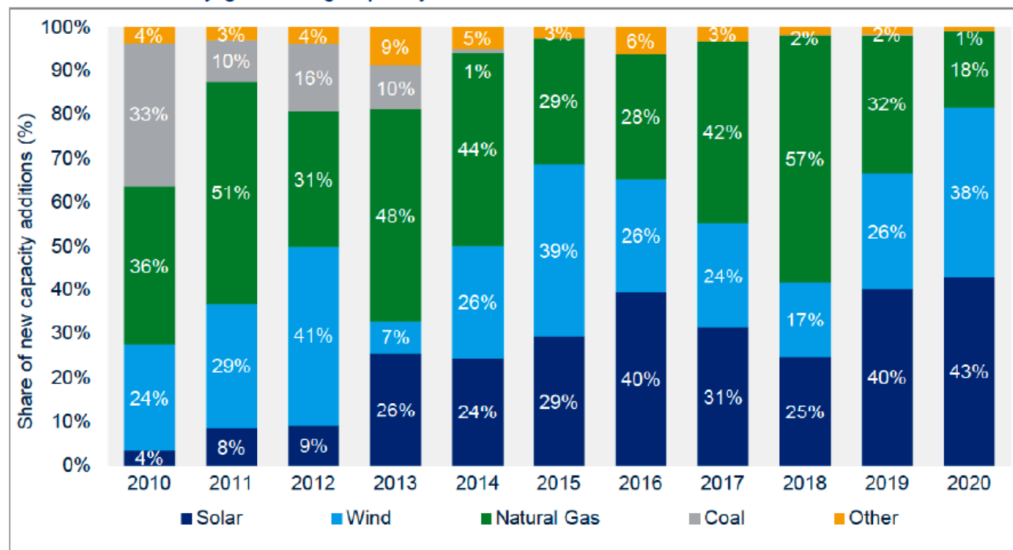
The next section includes the main subjects of this report which touch upon how Stonington can achieve carbon neutrality. These options are the best-in class that have resulted from our research into other municipalities. In line with Stonington’s ask to not “reinvent the wheel” we outline what can be pursued in the next decade to reduce the Town’s carbon footprint and advance sustainably focused policies.

## Carbon Reduction – Direct Strategies

### Solar Energy

In the month of March 2021 the Solar Energy Industries of America ([SEIA](#)) released a report that reviewed the growth of the solar market in 2020 with comparisons to relative growth over the last decade. The figure below shows that over the last decade the solar industry has had incremental growth in the earlier part of the decade. Though there are fluctuations in new capacity added between 2015-2018, the overall trend shows that solar is increasingly being adopted in the United States. For the context of this report, we will be discussing rooftop and ground mounted solar.

New U.S. electricity-generating capacity additions over the last decade



Source: Wood Mackenzie, Federal Energy Regulatory Commission (for all other technologies)

*Rooftop Solar*

Rooftop solar is an accessible technology that has proven renewable generation which has driven its acceptance in the mainstream market. Growing acceptance may be attributed to the scalability of the technology as well as the general ease of connecting it to the electrical grid. Additionally, it is one of the technologies that avoids the complexity of federal regulations required for hydroelectric power as well as the high capital costs of wind generation technology.

Due to this, rooftop solar is a potential avenue Stonington may take to reduce its carbon emissions. For Stonington, this would mean leveraging all of its existing municipally owned infrastructure to be retrofitted with roof mounted solar arrays. Any solar installations which Stonington does install on its buildings would require engineering studies to calculate if the additional load would be accommodated. Since the town has a historic character it is possible that many of the older buildings within the lots would need to install additional roof beams to support heavier loads.

Additionally the municipality would need to factor solar array maintenance into the decision process. Since the output energy generation is dependent on the glasses ability to absorb sun rays, any surface soiling that occurs from dust and air particulates accumulating must be periodically maintained. Any cleaning that needs to be done is on average recommended at least once a year. Maintenance of the solar arrays should not discourage the municipality from pursuing this option since the overall benefits trump relatively limited cleaning costs throughout the year.

When considering this type of solar option, the municipality should assess its building portfolio to designate those that may be retrofitted. If a large portion of buildings is unable to accommodate the additional load of solar arrays, then the municipality could potentially begin to designate buildings that will need roof repairs in the near future.

Coordinating solar installations to overlap with needed roof repairs would limit capital costs of integrating the technology when the current roofs have reached the end of their useful lifetimes. Adding rooftop solar panels to buildings that can accommodate them would transition the internal system away from a carbon based system towards renewable energy generation.

Through contact with the Town of Stonington our group was provided a draft version of solar zoning that was going to be presented to the Board. We recommend that the municipality amend broader solar regulation that encourages the technology. Similar to Stonington's characteristics, the [Town of Norfolk, CT](#) under Chapter 180 regulates zoning laws which include

solar standards that have worked for their community. In the appendix also include references to solar zoning guidelines in the State of Massachusetts along with information from SolarizeCT.

### *Ground Mounted Solar*

Ground mounted solar is a great opportunity to increase renewable energy. Compared with rooftop solar, there are both drawbacks and advantages to ground mounted solar. The main drawback is that ground mounted solar has a higher upfront installation cost. However, ground mounted solar has the ability to capture more sunlight, because unlike rooftop solar which must be positioned in alignment with the roof, ground mounted can be built to point in the direction, and at the angle, to capture the most sunlight. Furthermore, ground mounted solar allows for easy repairs should the solar panels get damaged in any way.

There are also a couple different types of ground mounted solar. The first one is standard mounted, which is fixed to the ground at a set tilt. The other type is pole mounted, which elevates the solar panels higher off the ground, and often tilts automatically to allow the solar panel to track the sun and absorb the most energy. Standard ground mounted solar is best for carports, while pole mounted could be used in an open space where there are less objects around the solar panel.

Ground mounted solar can be considered for both open land, and parking lots, although if the parking lot is an area where buses, or other tall vehicles routinely drive, then they would need to be at least 16 feet at the tall end to ensure vehicles avoid any logistical problems. Special permitting might be required for which some regulation might need to be produced by the Planning and Zoning commission in accordance with local laws. As such, it might make more sense to install ground mounted solar panels in parking areas or districts where tall vehicles are not permitted. Additionally, where there are open stretches of town owned land, it makes sense to consider if ground mounted solar panels could be installed. One recommendation we see has potential energy generation potential through this strategy would be the underutilized patch of land in front of Stonington High School.

### *Financing Groundmounted and Rooftop Solar*

Using solar array technology in Stonington has numerous advantages that advance a environmentally conscious source of energy. Prioritizing the implementation of these solar

systems are steps Stonington may consider to reduce its carbon footprint at the municipal level. Apart from installing solar arrays on municipality owned property, Stonington may also choose to leverage programs that either finance or subsidize a transition to clean energy.

One example of this is [C-PACE](#), known as the Commercial Property Assessed Clean Energy program, a national initiative that has been adopted by the Connecticut state legislature. C-PACE encourages investment in commercial clean energy options through financing capital via a voluntary tax assessment program. By financing projects this way, commercial properties are able to benefit from a long-used and proven tax mechanism that alleviates the burden of repayment, allowing transferability of obligations to the next owner , and providing longer term financing. The Connecticut Green Bank currently is providing potential loans to municipalities for C-PACE.

## Geothermal

Geothermal well systems is the second alternative that Stonington should consider as a method to transition the municipality owned buildings off of carbon infrastructure. These systems use the energy that is stored below the earth's surface to transfer energy into structures. Geothermal heating uses stored ground energy to heat during cold months while in the summer months it provides cooling by dispersing heat into the ground. The particular system we recommend for Stonington is known as [ground source heat pumps](#) (GHP).

When considering this renewable energy technology the Town of Stonington should be aware of the installation costs for these systems. Unlike the relative ease of solar array installations on the exterior of buildings, geothermal systems need to be installed underground below or around buildings. The Department of Energy contextualizes that although the purchase and installation cost of a geothermal heat pump system is often higher than that of other heating and cooling systems, properly sized and installed GHP's deliver more energy per unit consumed than conventional systems.

As with solar, geothermal energy allows retrofitted buildings to be self-producing energy centers that are at times more productive than solar. This is because since solar depends on seasonal changes and shifts in angular placement of the sun, geothermal taps into the unlimited resources beneath the soil. For Stonington, installed geothermal systems would provide heating

and cooling via a sustainable ground source conversion method that replaces current carbon-consuming boilers.

An example of a Connecticut municipality which recently implemented this proven technology is the [Town of Greenwich](#) at one of its schools. By using clean energy grants and rebate credits, the town found that using this technology to replace their carbon infrastructure at the end of its natural lifespan was a cost saving investment as opposed to a new carbon consuming unit. Additionally, since the school's geothermal systems were producing energy, the operational expenditures were significantly less since they no longer needed to purchase fuel. Greenwich sees the conversion as a standardizing process occurring in the market that will result in long-term savings for their municipality.

## **Carbon Reduction – Indirect Strategies**

### Community Engagement

As the Town of Stonington, and Connecticut at large, shift toward 100% renewable energy, community engagement and education will be a critical component. Some residents may be skeptical of the move towards renewable energy and sustainability, while others may wish to engage in the process, but be unsure how to do so. As such, community events can be a good way to engage residents in the transition to renewable energy and convert your districts into a sustainably conscious and clean energy production municipality. Experts can be brought in to speak about geothermal, solar energy, renewable energy transitions, and sustainability in general. Materials used for these community events can also be made available online, so that residents who are unable to make it to the actual event can still access and refer back to the content.

One example of an increasingly common municipality program finding broad acceptance is community composting. Westchester County in New York State, in an example we reference. Just a few years ago, the [Village of Scarsdale](#) launched a first of its kind composting program funded by the municipality that allowed residents to drop off food waste at designated sites. A relatively simple process, composting requires the municipality to provide a drop-off site for compost waste that must also be coordinated to be composted either locally or in another area.



On the community side, all it takes is education to make the public aware of how to properly separate food waste from non-organic waste. A program such as this vastly reduces the general trash stream entering waste facilities and also subconsciously makes residents more aware of food waste. Stonington should consider a program such as this due to its relative ease and the inclusionary accessibility into environmentalism for residents.

Along with general community events, educating students is also very important, especially since young people will feel the worst effects of climate change. Hence, school programs can be helpful in educating students about climate change, as well as about solutions, such as renewable energy. If solar panels, or other sustainable initiatives such as pollinator pathways - native pollinator habitat that is pesticide free - or composting are done on school grounds, then they could be used for interactive learning.

## Energy Efficiency

Energy efficiency is an important part of reducing the strain on the electric grid, as well as reducing GHG emissions. As such, ensuring that all buildings are as energy efficient as possible is a big step towards reducing our greenhouse gas emissions, and transitioning to renewable energy. In addition to having climate change benefits, it also saves money, because the energy cost for the building will go down.

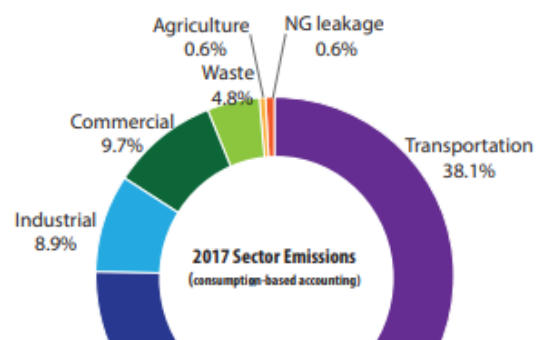
Additionally, while Connecticut does not currently have stretch codes, which “allows cities and towns to opt in to requirements for higher levels of energy efficiency in new buildings,” ([Acadia Center](#)) advocates are working to get a [bill](#) - HB 6572 - passed in the CT General Assembly that would create them. Once created, these codes will also help municipalities move towards greater energy efficiency and less GHG<sup>1</sup> emissions.

## Transportation

Transportation is one of the biggest contributors to climate change in Connecticut ([DEEP](#)). As such, it is very important that action is taken to reduce emissions from this sector.

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<sup>1</sup> Defined as Greenhouse Gas Emissions



Electric vehicles are becoming more affordable ([Bloomberg New Energy Finance](#)), and a great option not only for private automobile owners, but also for municipal fleets. Not only do electric vehicles not produce air pollutants while being driven, reducing asthma and other respiratory illnesses, but they also convert energy much more efficiently than combustion engines ([US Dep. of Energy](#)), so even though they may be relying on fossil fuels from the energy grid, the fossil fuels are being used more efficiently and less commonly.

A recent example from a large metropolitan city in the suburbs just outside Manhattan, the [Town of Yonkers](#) just added a fully electric Tesla vehicle to its police fleet. The basis of this decision was not only in line with their own green policy to electrify the municipality fleet but also because of its added cost savings over time.

Additionally, other forms of green transportation can be improved in municipalities, by purchasing electric buses for transportation around the municipality, expanding walking and biking paths, and purchasing electric bikes that could be rented from the municipality, etc.

## **Recommendations**

In the previous sections we touched upon many potential pathways that the Town of Stonington may take to reduce its carbon footprint through direct and indirect carbon reduction strategies. Based on the research done in the previous sections, we now make the recommendations in these sections to the Town of Stonington to consider as next steps.

**(1): Adopt or amend legislation that includes solar zoning regulations into the local law that improves consideration and ease of accessibility for community members.**

**(2): Commission a study to consider all municipality owned buildings, schools, and land. Buildings should be studied for potential rooftop solar conversion while under-used parcels with no other purpose should be considered for solar arrays where applicable.**

**(3): Commission a study to consider implementing geothermal systems at all municipality owned buildings and schools. The study should conduct tests on the ground under these buildings to estimate the production capacity of the geothermal heat pump systems.**

**(4): A community event about renewable energy, with speakers on geothermal or solar conducted by a designated public commission or committee within the municipality that focuses on climate change.**

**(5): Use solar panels, composting, and pollinator pathways as community engagement programs. Leverage the school districts to include interactive learning with students<sup>2</sup> and evaluate engagement for additional programs.**

**(6): Conduct an evaluation of which municipality owned buildings can have increased adoption of energy efficiency strategies. Retrofitting can adopt stretch codes once they are passed by the CT general assembly.**

**(7): Stonington should consider electrifying its fleet of cars. Investments in clean transportation should be considered through creation of bike lanes, consideration of electric public vehicles, and improving pedestrian facility conditions to encourage less vehicle mobility in general.**

## **Conclusion**

Through expanding renewable energy, increasing Stonington's overall energy efficiency, prioritizing green transportation, engaging residents and students in the process of transitioning to renewable energy, and an overall more sustainable municipality, we believe that Stonington can take immediate action to begin moving towards carbon neutrality.

The recommendations presented are pathways that have considerable benefits to Stonington when implemented while having relatively little or no risk to the municipality. Further these actions do not need any state or federal approval putting the full authority to act on these actions on the Board of Selectmen and the community. These recommendations should be considered as next steps the municipalities can take to incorporate carbon reduction strategies into their policy.

A common theme among the research done for this report was that the most successful programs in any reduction strategy began with community engagement. For the recommendations presented above, we recommend that the municipality engage all stakeholders into conversations on which to pursue first. By leveraging the public to contribute to the framework of a climate action plan the Town of Stonington will be able to successfully create a plan that reduces its environmental impact.

The next decade will encapsulate one of the most pivotal moments in environmental history. Already the movement on climate change has spurred action from state and federal authorities that are not only holding conversations on the topic but also passing increasing

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<sup>2</sup> Similar to what Mansfield Middle School did with composting ([DEEP](#)).

subsidies and grants to expedite the convergence. For this reason, Stonington should consider the financial benefits and opportunities as an additional benefit to reducing its carbon footprint.

## **Appendix:**

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