LONG ISLAND

FEASIBILITY STUDY

A Report for *Islands: Energy, Economy and Community*
College of the Atlantic, Fall 2014

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INTRODUCTION

Understanding the nature and role of energy in daily human activity provides valuable information in evaluating current and future needs as well as current consumption, its derivations and patterns (what and when). With this baseline, informed energy and usage decisions can be made, with consideration to impacts and consequences. This evaluation and dialogue process is key to adaptation within a dynamic world and its people.

Through the newly-established Fund for Maine Islands, College of the Atlantic and the Island Institute have partnered to combine academic research and experiential application to address essential matters affecting Maine-island communities. These matters include energy, food systems and education. The Fund for Maine Islands focuses on energy in 2014. At the Fund for Maine Islands 2014 summer reception, which honored Polly Guth, the Fund's philanthropist, journalist and political commentator Bill Moyers expressed:

> ... *We are reminded every day now — from Gaza to the Ganges to Ferguson — that civilization is but a thin layer of civility stretched across the passions of the human heart. If it snaps, all that we hold dear can disappear overnight. Whether this happens from belligerent and malevolent forces outside us (think 9/11) or from within — from the ferocious partisan conflicts that have deadlocked and paralyzed our governance,* ***or from the rising temperatures of the ocean, or the collapse of ecosystems****,* ***there will be no place to hide ... We are in this together****.*

PROJECT GOALS

CIERA Goals

The Island Institute has created the Collaborative for Island Energy Research and Action (CIERA) whereby five community representatives from Maine islands, who have demonstrated leadership qualities, have been selected to develop projects to further energy conservation and self-sufficiency efforts on their islands of residence. CIERA island participants include Long (Johnson), Peaks (Saltonstall), Swans (McAloon), Monhegan (Cioffi) and Vinalhaven (Trainor) Islands. Island representatives have partnered with College of the Atlantic students to examine economic, financial and social considerations in conjunction with current island energy needs and consumption

patterns. Planning and implementing greater energy-efficiency and self-sufficiency measures have been prioritized.

COA Course Goals

College of the Atlantic has developed an integrated, 3-credit 'monster' course *Islands: Energy, Economy and Community*, whereby under- and graduate students, during one full academic term (ten weeks), delve into the inter-related economic, technical and community aspects of renewable energy. In collaboration with Maine-Island CIERA community representative Nathan Johnson, undergraduate students Rebecca Coombs and Lucas Greco and newly graduated Kate Unkel ('14) have been collaborating to examine island energy needs, consumption patterns, historic events, community activity and values, towards the feasibility of implementing energy-efficiency and renewable-energy projects.

COA students and Maine Island community members studied independently and together at The Energy Academy, Samsø, Denmark. Samsø is a worldwide island model and inspirational beacon with its negative carbon footprint, achieved within ten years, and with widespread community support and buy-in.

Gateway Project Concept Goals

Nathan Johnson, an inter-generational resident of Long Island, Maine (whose family first arrived to Long Island in the 1700s), has proposed the development of a community road map. This map explores the feasibility of pursuing appropriate technological, financial and social approaches of renewable energy on Long Island. Renewable energy project goals have been developed to offset electricity and heat expenses associated with Long Island municipal buildings, to introduce residents to community-based renewable energy efforts and to complement planned energy efficiency efforts on the Island. See Appendix A (Summary - Samsø Experience) for further summation of the Samsø experience.

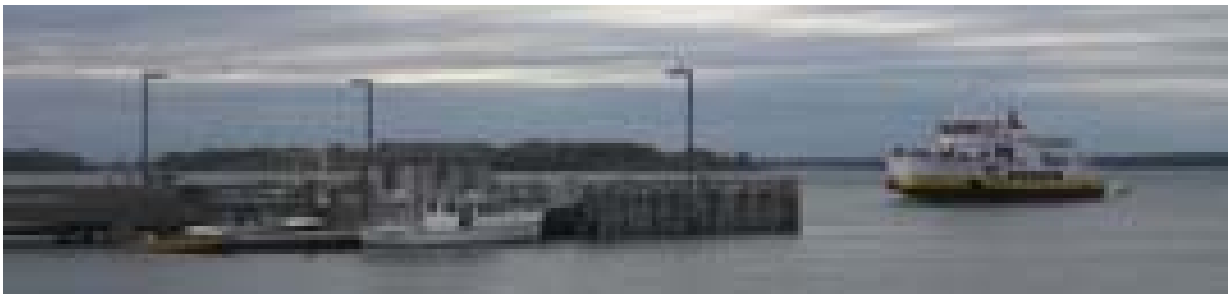
LONG ISLAND CONTEXT
Historical Context

Long Island, originally inhabited by Native Americans, saw the arrival of westerners in the 1600s. Colonel Ezekiel Cushing purchased the island in 1732. He is seen as the first European westerner to settle and build a home on Long Island. He willed the island to his nine surviving children at his death in 1765. Other settlers arrived to farm and fish (including lobsters). Nathan Johnson is an ancestor to Colonel Cushing. Jacob Johnson, another ancestor, settled in Casco Bay (Harpswell, then Bailey Island) in the mid-1700s. See Appendix B (Johnson - Family Genealogy Chart).

During WW II Long Island served as a fueling depot for the U.S. Navy. Supply stations and army buildings were constructed to add to Casco Bay naval defenses. Many buildings still stand along the shore, both municipally and privately owned. The Island is one of fifteen Maine islands that have year-round communities.

Long Island is situated in Casco Bay, six miles off Portland's coast. It is 3 miles long, 1 mile wide. It serves a winter population of 230, which swells to over 1,000 in the summer. Local facilities include an Emergency Fire and Rescue vessel, Library, School, VFW, Recreation Center, Community Center, Town Hall, post office and two stores (one year-round). Selectmen meet each Thursday year-round at Town Hall. Each May the Town convenes its annual meeting to vote on capital-improvement projects. Local industries include fishing (lobstermen, who primarily use diesel fuel), and services (construction, landscape, rental house cleaning, etc.). The current Island school enrollment for Grades K-5 is 17 students, with two teachers. Students in Grades 6 and older commute daily to Portland. In 1993, Long Island residents successfully seceded from Portland, in response to Portland's reassessed property and tax rates, whereby Long Island rates had tripled. The Town became the first new Maine town since 1925.

Community Context



Rebecca Coombs, Lucas Greco and Kate Unkel, (the Team) traveled to Long Island in mid-October to tour the Island, speak with residents and assess sites for potential renewable energy projects. Trip notes are detailed. See Appendix C (Community Visit to Long Island - October 2014*)*. They spoke with nearly twenty residents about Island living -- families of young children, lobstermen, Town Hall employees, teacher, entrepreneur, contractor, alternative energy homeowners and a volunteer community leader working with the Island Institute.

Based on historic events, the Long Island Town website and conversations with a dozen Islanders, the Team perceived a community ethos. Islanders spoke about:

* *Years later we have created a vibrant community where citizens take a strong and active role in improving the quality of life for all*[1].

* Pride, independence and confidence in determining their future (Since secession, their taxes have gone down by 30%).

* Active engagement in volunteer efforts. From a successful community-supported library expansion to an imminent community-center reconstruction, Islanders have donated significant local resources (time, money and knowledge) for the betterment of their community.

* *In many ways these frugal habits and extensive volunteer activity help to create the wonderful sense of community that defines the Town of Long Island. We are very grateful to our able and committed volunteers*[2]*.*

* Nurturing the next generation. The older island children (Grades 6 and higher) who attend Portland schools are well-prepared students, who transition smoothly from the Island school (Grades K-5)

Also, the Team met an infant at the first potluck, affectionately known as the 'community baby.' Cora was passed from one adult to the next throughout the evening.

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[1] Town of Long Island website, *About Long Island.* http://www.townoflongisland.us

[2] Town of Long Island 2008 Comprehensive Plan. http://townoflongisland.us/wp/?page_id=830

* Respecting inter-generational families, along with the histories and deep knowledge these families bring to Island living.

* Nathan's commitment to his family, the Island and implementation of renewable energy projects. His profession is in tidal and river-turbine renewable technology, where he works for Ocean Renewable Power Company. Among the island community, he is well respected, personally and professionally.

* *We're open to new ideas as long as they don't raise taxes*. These words represent a persistent sentiment heard during interviews. (This simple statement is key to social orientation when proposing renewable energy projects, given Long Island's successful secession).

Additional community themes and concerns emerged. These included:

* Re-population. An interest in new families and babies. School enrollment and grade configuration forecasts were projected, based on marriage dates of community members.

* Self-sustaining food systems. Outlets include: food buying club, community garden, recycling. Innovations include: compost, anaerobic digester, aquaponics.

* Education. Teacher is open to energy curricula and activities for Grades 3-5. She notes the school roof needs replacement in 2019 and mentions including solar panels (and hands-on learning) at that time.

* Elder care. Improving, as the population ages.

* Health clinic. An Island clinic is a necessary service.

* Workers. (0% unemployment rate, construction and fishing jobs are unfilled).

* Lyme's disease. During the past few years increasing numbers of residents have been diagnosed positive. Nathan has been treated twice. Currently the Town is culling the herd as a way to reduce deer and deer tick populations. Shooters use tree platforms. All meat is processed and distributed to Island families.

* Conservation efforts, including solar heat and heat pumps.

* Knotweed, as an invasive species.

* Tidal renewable energy for Hussey Ledge.

Team Process

Research - The Team gathered data from the Town of Long Island municipality, Maine Public Utilities' Commission and Central Maine Power (Iberdrola) to evaluate Island energy usage and patterns. Use of Solar Pathfinder equipment provided sun and shade readings for multiple sites, from which the Team calculated the solar potential with computer software. Island energy conservation and current transportation systems were assessed for avenues of potential energy reduction. The Department of Environmental Protection, Governor's Energy Office, articles and case studies provided local, State and federal ordinances, rules and regulatory parameters. Finally, wind and solar retailers and Camden Hills high school provided technical and financial information as the Team assessed and narrowed technological and financial proposal options for the Feasibility Study.

Energy Conference Presentation - The Long Island group presented for ten minutes at the Island Institute Energy Conference in Portland on November 7, 2014. Energy-industry stakeholders from around the nation, federal and State regulatory agencies, retailers, service providers, COA faculty and students, Island Institute staff and CIERA program participants attended day-long talks and break-out sessions. On November 8, the Team visited Peaks Island to observe construction and installed window retrofits, and presentations about proposed conservation projects at the elementary school, as community-wide energy conservation measures.

Community Presentation - On Saturday, November 8, 2014, the Team convened on Long Island, to give a twenty-minute presentation at the Town library. Attendees included Nate Johnson, Kate Unkel, Luke Greco, Rebecca Coombs, Barbara Johnson, Dick Murphy, Curt Murley, David Johnson, Doug Grant, Karen Grant, Erin Love, Ralph Sweet, Meredith Sweet, Mark Greene, Tommy Hohn, Michael Johnson, Kay Johnson, Moira Johnson, Will Tierney, and about 6 children. Questions and comments followed, as attendees expressed energy interests, concerns, etc. Themes included inquiry about steps needed to move from feasibility to implementation and potential impacts on taxes

(mil rate). Afterwards, the Team noted possible renewable energy project 'support' leaders, as well as ways of engaging residents through social media for further exchange of community ideas, questions, etc. Post-presentation, the Team participated with Long Islanders in the annual Harvest dinner community garden fundraiser, hosted in the VFW Hall. Approximately 100+ residents attended, with live music. The Team split up and dined with various community members.

Upon return from Samsø, Denmark,Team activities for the final seven weeks of COA Fall 2014 term, is shown below. See Appendix D for a detailed timeline (Long Island Timeline Detail - 2014 COA Fall Term [draft]):

Table I: Long Island Timeline - 2014 COA Fall Term

LONG ISLAND TIMELINE - 2014 COA Fall Term	Wk begins Oct 6	Oct 13	Oct 20	Oct 27	Nov 3	Nov 10	Nov 17
Long Island Team formation at Samso	X						
Visit LIsland - interviews, site assessments, potluck		X					
Solar pathfinder data entry; anemometer data logger research; wind product research; COA class lectures (rates-Tom McAloon; public advocacy for PUC-Tim Schneider; PUC-Tuck O'Brien; IInstitute-Suzanne MacDonald; DoE-Peter Davidson		X	X	X	X	X	X
Attendance SHE conference; De-brief Malene, Soren, Anna, Jay round-table, including class			X				

LONG ISLAND TIMELINE - 2014 COA Fall Term	Wk begins Oct 6	Oct 13	Oct 20	Oct 27	Nov 3	Nov 10	Nov 17
Luke - site visit to Camden Hills Regional HighSchool re. school wind turbine; Team attendance and presentation at Island Energy Conference					X		
Peaks Island site visit - window construction and retrofits					X		
Long Island visit - Library presentation and community potluck					X		
Revise and finalize Feasibility Study draft						X	
COA - Final presentations; submit final Feasibility Study							X

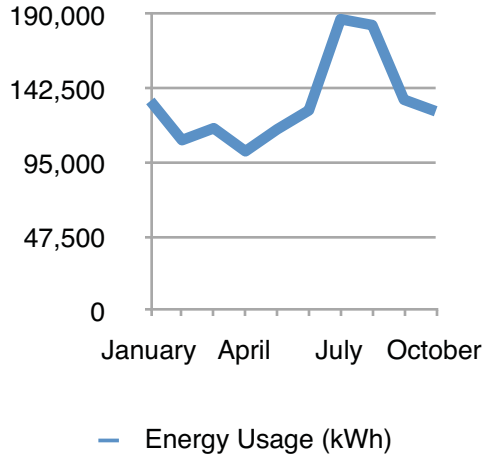
LONG ISLAND ENERGY USAGE
Island-Wide Energy Usage

Long Island is tied to Portland's electric grid and is served by Central Maine Power (CMP). The current CMP rate is $0.1316/kWh ($0.075603 standard offer + $0.056 delivery rate). Long Island's monthly electricity usage is 134,229 kWh. Total aggregated consumption for the Island from January through October 2014 is 1,342,293 kWh. The Team estimates annual aggregated consumption for a full year is 1,610,751 kWh. Transmission loss is estimated at 5%[3]. Therefore, the estimated annual Island-wide adjusted consumption is 1,530,217 kWh. The graph, below, illustrates Long Island's 2014 peak energy use through October 31. The peak begins climbing in June and drops in September, correlating to the swells in the summer population. See Appendix E

[3] US Energy Information Administration, US EIA, last updated May 2014, http://www.eia.gov/tools/faqs/faq.cfm?id=105&t=3

(Calculations of CMP Data - LI Whole Island from Jan 1 - Nov 10, 2014, including individual use).

Graph I: Long Island Total Energy Usage - 2014



Long Island Municipal Energy Usage

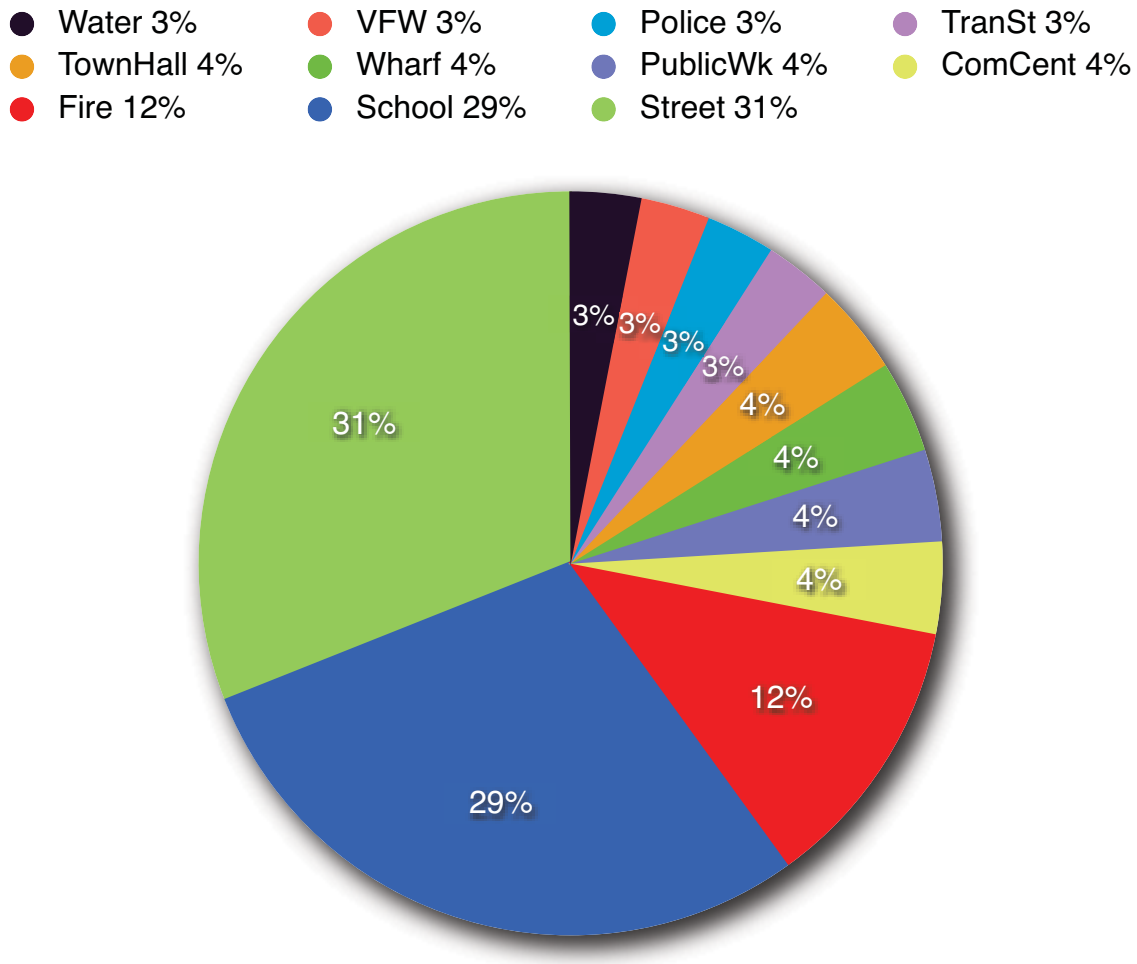
The Long Island municipal budget for July 2013 through June 2014 reflects electricity expenses allocated for the following buildings:

Town Hall	Wharf
Water Department	Street Lights
VFW Hall	Community Center
School	Public Works
Police	Transfer Station
Fire Department	

= $25,986

The team calculated the estimated energy usage for Long Island municipal buildings from the above dataset. Electrical usage for the municipality for one year totals 121,567 kWh, representing aggregated Island usage. Overall, the municipality is the largest electricity consumer on Long Island. Last year electricity expenses totaled $25,986. See Appendix F (Calculations for Long Island Municipal Energy Usage Breakdown 2013-2014). The largest electricity-expense allocations are Street and Wharf Lights, which combined comprise the total municipal lights billed to the Town of Long Island. Street and Wharf Lights represent a third of the total electricity for municipal buildings, and represent half the cost of the municipal buildings. The next largest electricity allocation is the Fire Department (12%, $1,911 @ 14,521 kWh).

Graph II: Total Municipal Energy Need 2013 - 2014



Household Energy Usage

Data from the 2010 US Census indicates 230 Long Island residents live year-round, totaling 99 households[4]. In estimating the non-municipal electricity usage from CMP and budget sources for January, the total electricity used for all homes on Long Island is 123,706 kWh, representing 1,250 kWh used in each household/539 kWh used per person. Comparatively, the average electricity usage in Maine households for January is 531 kWh[5]. Further, US Energy Information Administration cites the average monthly kWh consumption in New England is 7500 kWh/yr/household.

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[4] 2010 US Census Report, http://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml and http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF

[5] US Energy Information Administration, US EIA, 2012 Average monthly bill.

Heating and other fuels are transported to Long Island by marine transport to supply residential, commercial and municipal usage (not including electricity, the 'fuel' for heat pumps). Currently No. 2 heating fuel, propane, diesel and gasoline fuels are shipped to the Island. According to the 2010 US Census, Long Island households use a variety of heating fuels. They are listed below. See Appendix G (US Census, 2008 - 2012 American Community Survey - 5-Year Estimates). Heating costs are 25% more than on the mainland.

Table II: Long Island House Heating Fuel 2008 - 2012

Subject	ZCTA5 04050			
	Estimate	Margin of Error	Percent	Percent Margin of Error
HOUSE HEATING FUEL				
Occupied housing units	153	+/-34	153	(X)
Utility gas	2	+/-4	1.3%	+/-2.7
Bottled, tank, or LP gas	8	+/-7	5.2%	+/-4.6
Electricity	0	+/-10	0.0%	+/-13.6
Fuel oil, kerosene, etc.	113	+/-30	73.9%	+/-11.7
Coal or coke	1	+/-3	0.7%	+/-1.9
Wood	25	+/-17	16.3%	+/-10.4
Solar energy	0	+/-10	0.0%	+/-13.6
Other fuel	4	+/-5	2.6%	+/-3.4
No fuel used	0	+/-10	0.0%	+/-13.6

CONSERVATION

Energy efficiency efforts are the easiest and most cost effective conservation measures. They are first priority when developing renewable energy plans, by offering residents quick returns on investments and by offering education about energy use and options. Oftentimes successfully addressing residential and commercial conservation efforts engenders positive individual responses, which lead to community support and approval. Potentially, this can lead to greater community openness and trust for future renewable energy projects.

To date, energy efficiency efforts on Long Island have been implemented either by individual homeowners or by Island Institute initiatives. During the winter of 2013, Brooks Winner, Community Energy Associate with the Island Institute, hosted an interior storm window insert building workshop with former Island Institute Fellow, Erin Crowley. During the workshop, they introduced the idea of an on-island "Weatherization Week." In March 2014, the Island Institute received an Efficiency Maine contract for public

information and outreach[6]. *Weatherization Week* focused on energy conservation work on six islands and development of informational materials for homeowners' projects beyond 'low-hanging fruit.' Projects included air sealing and more impactful measures like commercial spray foam and heating system upgrades. During Spring 2014, the Island Institute, Erin Crowley and Long Island resident volunteer Mark Greene set up a Weatherization Week, providing eight home energy audits and six hours of air sealing and insulation labor for a cost of $200 per home. Homeowners were offered the option to follow up with additional measures such as basement or attic insulation or heat pumps. Mark Greene has identified ten residential property owners interested in heat-pump installations. He anticipates placing a bulk order in Spring 2015. To date one Island Institute-associated heat pump has been purchased and installed. Other independent installations include two recent residential applications and CIERA leader Nathan Johnson, who installed a geothermal heat pump in 2009. During community conversations, the Team captured notes about municipal buildings. See Appendix H (Long Island Municipal Buildings - Detailed Energy Notes Oct 2014).

Island residents and commercial enterprises are eligible for loan funding for energy savings improvements in the forms of PACE (Property Assessed Clean Energy) and Powersaver Loans through Efficiency Maine.[7] Possible improvements include air seals, insulation, efficiency upgrades (heating system, hot water heaters, improved controls and thermostats for furnaces and boilers), and/or renewable energy installations, including photovoltaic, solar thermal, biomass, landfill gas to energy, geothermal, wind, wood pellet and other eligible systems. Preliminarily, Long Island residents are eligible because the Town of Long Island Code of Ordinances includes PACE program language. See Appendices I and J (I: Town of Long Island Code of Ordinances - Table of Contents, Revised May 10, 2014 and J: Town of Long Island Code of Ordinances, Chapter 16, Articles I-V, Property Assessed Clean Energy (PACE) Ordinance).

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[6] Efficiency Maine, http://www.efficiencymaine.com/opportunities/awarded-contracts/

[7] Efficiency Maine independently administrates energy efficiency programs in Maine. Its mission is to lower the cost and environmental impact of Maine's energy consumption. It is governed by a stakeholder Board of Trustees, with oversight by the Maine Public Utilities Commission. http://www.efficiencymaine.com

TRANSPORTATION

Transportation includes privately, commercially and municipally-owned vehicles and private golf cars, most of which are gas powered. However, 12 of 142 registered golf cars are electric. The Island supports a seasonal golf cart rental business. There are no hybrid vehicles on the Island. Privately owned vehicles are often referred to as 'Island cars' because they may not be maintained regularly. A number of winter residents keep second cars in Portland lots because car rates on the ferry are cost prohibitive. The 2010 US Census enumerates the vehicle fleet on Island.

Table III: Long Island Vehicles Available 2008 - 2012

Subject	ZCTA5 04050			
	Estimate	Margin of Error	Percent	Percent Margin of Error
VEHICLES AVAILABLE				
Occupied housing units	153	+/-34	153	(X)
No vehicles available	17	+/-13	11.1%	+/-7.9
1 vehicle available	50	+/-22	32.7%	+/-12.1
2 vehicles available	61	+/-19	39.9%	+/-11.5
3 or more vehicles available	25	+/-17	16.3%	+/-9.6

The Town of Long Island owns and operates a Fire and Rescue vessel for emergency marine purposes. Municipal records for July 2013 - July 2014 indicate vessel expenses totaled $2,600.

Lastly, Long Island is serviced by the Casco Bay Lines' ferry, which transports people and vehicles to seven islands in Casco Bay (five-ferry fleet). Casco Bay Lines is owned by the Casco Bay Island Transit District (CBITD), a quasi-municipal, non-profit corporation, which was established in 1981 through emergency State legislative action to ensure the continuation of service to the islands. All five ferries run on diesel fuel.

LONG ISLAND ENERGY RESOURCES

Assessing local resources is the first step in developing a renewable energy road map.

Wind

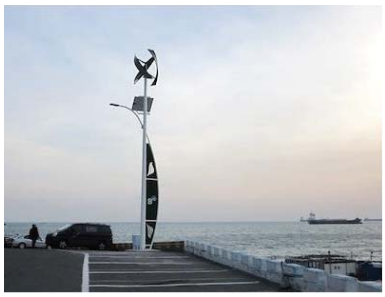
Initially, to accurately determine Long Island's wind resource, the Team explored procurement of a meteorological (MET) tower to collect data. Initial ordinance review clarified the need for a Town variance application due to a Town ordinance on maximum height construction. Secondarily, the Team researched purchasing anemometers and data loggers for attachment to Wharf lampposts. Logistics, academic time constraints and an initial lukewarm to negative response from several residents compelled the Team to examine other wind data sources. (See Citizens Task Force for Wind Power - Maine, Dec 5, 2011, http://www.windtaskforce.org/profiles/blogs/peaks-island-gives-up-on-wind-power)

Therefore, Long Island wind data is derived from available online mapping, as well as data collected on nearby Peaks Island. National Renewable Energy Lab (NREL) maps for Maine indicate average annual wind speed (at 30 meters high) is between 5-7 mph in the Casco Bay area. This is considered a "fair/good wind resource." See Appendices K and L (K: Maine - NREL Average Annual Wind Speed at 30 m and L: Maine - NREL Annual Wind Speed). Neighboring Peaks Island previously collected MET tower data at 30 meters over a one-year period. That two-year study concluded, "... the wind resource was not sufficient to justify the purchase of a wind turbine at that time." See Appendix M (Summary of University of Maine's Final *Wind Data Report,* Peaks Island).

Additionally, Portland Airport anemometer records indicate the average on-site wind speed is 3 meters/second, with a high of 14 meters/second over the course of a year. As a reference point, the cut-in speed (speed at which turbine blades begin to spin) for a Northwind 100 kW wind turbine (basis of Peaks Island research) is 3.5 meters/second. Also, it is widely agreed that small-scale, land-based wind -- that under 100 kW -- is not cost effective in Maine.[8] Of the mentioned data sources, Peaks Island data is most reliable since it was collected at the closest geographic point to Long Island.

In the future if Long Island chooses to monitor its wind resource over an extended time, Mick Womersley at Unity College may have access to MET tower equipment. A potential Long Island site for testing is the Town Transfer Station. Potential community-supported wind development at this site offers close proximity to three-phase power and is situated in the center of the Island (electric hook-up ease and minimal disruption to water view sheds).

[8] Dana Fischer, Residential Program Manager, Efficiency Maine, www.efficiencymaine.org and Anna Demeo, Director of Energy Operations and Management, College of the Atlantic, www.coa.edu



Another site for introduction and exposure to wind energy, as a demonstration project, is at the Wharf, where sculptural wind turbines may be attached to existent lampposts. The idea was originally proposed by Nathan. The idea has great merit as an educational tool at the Island's ferry gateway. It offers a pleasing aesthetic, education value and slight electric benefits, especially if the idea were funded through philanthropic and/or grant means. Currently the payback prohibits its feasibility, as a community-supported project.

In conclusion, given the overall results of the Team's research efforts, a wind project is not the ideal direction for introducing renewables at this time.

Solar

Preliminarily, online data from NREL states a 4.5-5 average annual DNI (kWh/sq.m/day) for Maine. PV Watts indicate a 40 km monthly grid cell, with 4.21 DNI annually at Long Island's 43.555 latitude and -70.054 longitude readings. In the field, the Team identified several sites with promising solar resource, with an eye towards the implementation of a community-supported solar array. The image below indicates the original test sites. These include three canopy sites at the ferry landing parking lot, one wharf lamppost site and one ground-mount parking lot site (sloped).

The Team discussed three additional sites, based on site possibilities and/or community conversations. Those included the elementary school roof (slated to be re-roofed in 2019), the Fire Department roof (good southern exposure with no shading. However, residents noted building renovations are needed.) and a-top the Transfer Station capped landfill. A final site, as after-thought for future investigation, includes the very high roof of the boat storage facility, situated on the westerly end of the Wharf area, Town Lot 502, owned by Enterprises I, LLC.

Field data was collected by using a Solar Pathfinder[9]. This tool is used by professional photovoltaic installers, in combination with computer software (data analysis), to determine the most economical and efficient photovoltaic array location and position.

[9] See www.solarpathfinder.com

Analytical findings yielded positive results. Data from each test site is listed in Appendix N (Solar Pathfinder Data and Analytical Findings).[10] The basis for selecting one site over another involved reviewing analytical findings for each site, then factoring in site-specific dynamics. Currently and overall, Site 4 is the most favorable for erecting a first solar array. Site reviews are detailed and ranked from most to least in potential for renewable energy projects. See Appendix O (Solar Site Selections - Rationale), excepting the top two ranked sites, which are detailed in sections *Site 4* and *Site 5*, below.

In conclusion, Long Island has a strong solar resource, which offers favorable cost savings to current electricity usage. The opportunity to net meter up to ten accounts through CMP offers advantages to reducing municipal electric expenses. The cost savings is even greater, coupled with implementing conservation measures and upgrades in municipal buildings. Paybacks and returns on investment vary between sites.

Tidal

In response to community conversations about potential tidal energy at Hussey Ledge, the Team had discussions with Nathan. He has considerable work experience in tidal and river-turbine technology with his employment at ORPC. Nathan explained that current tidal renewable energy is a ‘nascent’ technology, and perhaps in the future it may be a more viable option.

In conclusion, the Team determined no potential for researching tidal renewable technology at this time.

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[10] ***Note:*** *It is recommended that second readings be taken on actual corners of any proposed array for most accurate findings*.

Biomass

The Team did not investigate biomass potential as an energy source, though it was utilized in centralized district heating as a viable energy resource at Samsø, Denmark. The premise of biomass energy is using harvested agricultural crops for heating fuel, by which biomass is burned. Heat is piped underground to local residences. Neither agricultural crops nor resultant residue are available on Long Island. Storm blow-down trees may be used as a fuel source; however consistency and reliability are issues. Many Long Island homes are built on ledge, impeding underground pipe installations.

A potential biomass resource is organic Island waste, which can fuel an anaerobic digester. Anaerobic digestion is the controlled decomposition of organic matter, which uses captured methane gas as a fuel source. Currently some organic waste is composted for home and/or community gardening. Installation and overhead costs for anaerobic digesters are high. Due to time constraints, the Team did not collect data on the volume of organic Island waste production.

In conclusion, little to no available crop and residue resources warrant further investigation of this biomass energy option. Organic Island waste production may be studied to determine its potential as a resource. Biomass is worth re-examining in the future if small-, large-scale farm operations open on Long Island. For heating purposes, current conservation efforts (bulk heat pump purchases) offer greater energy efficiency solutions.

Community

Human perspective and time, individually and collectively in community, provide great energy sources. Long Island has an abundant ‘attitude’ resource to integrate with technology and financial dynamics, towards developing a renewable energy projects’ road map.

Nathan is a well-respected and inter-generational community member on Long Island. Long Islanders successfully achieved secession from Portland twenty-one years ago, and formed the first new Maine town in 65 years.[11] Secession is no simple separation, given numerous town and U.S. state efforts through the years. In fact, several southern states were unsuccessful in their efforts to secede during the Civil War. In more recent

[11] Sauerwein, Kristina, “Big City Voted Off the Island,” *LA* Times*,* Sep 20, 2002*,* http://articles.latimes.com/2002/sep/20/local/me-mainesecede20/2

years, Long Island's neighbor, Peaks Island, has been unsuccessful in its three attempts to secede.[12]

Long Islanders' commitment to initiating and following through to successful secession relied on involving all supporters, communicating openly and informatively, having historical knowledge, and priding themselves on their Yankee roots and independence. Their stories and values have imbued Island residents with a sense that they can influence their destiny during the past twenty years. Additionally, Islanders understand and rely on their interdependent relationships with neighboring family and friends, perhaps unconsciously: It is embedded in their social fiber. Long Islanders' daily living is imbued with behaviors, attitudes and values that cohere their local, cultural connection to each other.

In conclusion, Long Islanders possess an abundant energy resource, given a secession under their belts, a clear understanding of community interdependence and a deep commitment to their community.

Key Points

The Team's research indicates that of the preceding renewable energy possibilities, solar energy represents the best available resource on Long Island at this time. Energy consumption and wind/sun resources fluctuate seasonally. Winds blow strongest from north-northwest during autumn and winter months (1/2 year) and settle to a breeze during spring and summer. Summer provides solar gain at a time when energy demand from a larger Island population is greater. In the future wind, in tandem with solar, has potential to mitigate seasonal fluctuations of solar and wind resources and Island energy usage (as wind technology develops and prices drop). Pursuing combined solar and wind projects requires thoughtful planning to educate and cohere community members about the financial, social and ecological benefits.

MARINERS' WHARF GATEWAY PROJECT

Goals

The broad goals for the Mariners' Wharf Gateway Project are to create a renewable energy roadmap by identifying and implementing appropriate technological, financial and social approaches for projects on Long Island. Project goals include offsetting

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[12] MacIsaac, Kimberly Erico, "Secession Talk on Peaks Island is Nothing New," *Heritage in Maine,* Feb 26, 2011, http://heritageinmaine.blogspot.com/2011/02/secession-talk-on-peaks-island-is.html

municipal expenses to benefit the whole Town, and introducing Island residents to community-supported renewable energy project options.

Original Gateway goals were introduced to the Team at Samsø by Nathan. His concept was clear. Then, the Team (including Nathan) agreed to proceed with open minds, recognizing community conversations and research results might likely change the original concept and direction of developing projects. At time of Feasibility Study writing, project goals had become more specific:

* Offset electricity and heat expenses allocated to Long Island municipal buildings and street lights;
* Introduce any renewable energy projects in a phased approach

Original Concept

The original concept, as conceived by Nathan, proposed renewable energy projects. See *Relevant I: Sites Considered for Gateway Project (as of Oct 2014)*, below. The projects included installation of:

* Solar/wind hybrid lighting system - Town dock
  To generate the equivalent of its own power usage, while introducing aesthetic (and educational) interest to ferry passengers;

* Solar car canopy - Main parking area at Wharf
  To generate electricity to offset municipal buildings and to offer cars protection from the elements;

* Electric car charger, and potential charging station - Dock
  To provide shore power to the Emergency Fire and Rescue vessel, and potentially to introduce and incentivize Islanders to switch to electric golf carts and vehicles, while offering electricity to current golf cart users;

* Community-supported wind turbine (100 kW) - Transfer Station
  To generate electricity to offset additional electricity use on Long Island and to cohere community support. This site is municipal land, situated in the middle of the Island, which minimizes potential disruption of residents' water-view sheds. Also, it is located near a three-phase power source.

* Community-supported solar array - Transfer Station
  To generate electricity to further offset electric use and to cohere community support. Again, this site is municipal land, located near a three-phase power source. It utilizes otherwise unusable land (capped landfill) and minimizes potential disruption of residents' views.

Relevant I: Sites Considered for Gateway Project (as of Oct 2014)

Expanded Assessment of Options

During the investigation and research phase of this study, the Team incorporated new information and analyzed additional solar sites during the first visit to Long Island. For example, the orientation of the originally conceived solar car canopy (main parking area) was not ideal. Oriented at 135 degrees instead of due south meant the canopy roof required a maximum 15-degree tilt, instead of the ideal 43.63-degree tilt. As a result, less sun exposure on panels throughout the day significantly reduced potential solar production. Newly assessed sites included a car canopy along the waterfront, a ground-mount across the road from Town Hall, situated near long-term parking, and a car canopy on the northerly side of the Town storage building. See *Relevant II: Revised Sites Considered for Gateway Project (as of Nov 7, 2014)*, below.

Relevant II: Revised Sites Considered for Gateway Project (as of Nov 7, 2014)

Assessments and overall rankings of the most to the least potential for renewable energy projects at each site involved:

* Analysis of Solar Pathfinder data
* Evaluation of merits and challenges
* Financial calculations (factoring array size and installation costs)

Again, site review details, rationale and rankings are detailed in Appendix O (Solar Site Selections - Rationale), excepting the top two rankings which are detailed below. Overall, Site 4 is most meritorious for construction of a first solar array. Rankings follow as: 1 'most potential' through 5 'least potential' for renewable energy projects. Rankings are subject to change with identification of appropriate funding strategies and sources.

Ranking 'Potential'	Site	Location of Array	
1 (most)	4	Ground Mount	- Long-Term Parking
2	5	Car Canopy	- Town Storage Parking
3	1	Car Canopy	- Main Parking
4	3	Car Canopy	- Waterfront Parking
5 (least)	2	Solar/Wind Hybrid Lampposts	

Site 4 and 5 Detailed Assessment

The locations of these municipal lots are zoned as IB commercial in Town of Long Island Code of Ordinances. Site 4 is zoned VE per determined base flood elevation. Town ordinances relating to these sites are found in Chapters 6, 13.4, 14, 16 and 17. Neither solar-array installation is restricted by shore land building setbacks nor flood plain zoning. See Appendix P (Town of Long Island Flood Insurance / Zoning Maps)[13].

Site 4) Ground Mount - Long-term Parking

Ranking = 1

[13] Long Island Town Ordinances and Flood Insurance Rate Map, Cumberland County, Maine, preliminary November 5, 2013, Map No. 23005C0733F.

This site was discovered on the Team's Island visit. Potentially, it is the best site of those evaluated.

Merits include:

* Excellent solar resource
* Ground mount enables exact orientation and tilt for optimal solar gain
* Ground mount (no construction costs, as compared to car canopy structure)
* Minimal impact on unusable municipal land
* Sloped hillside provides lower visual profile to solar array
* Minimal to no impact on views

Challenges include:

* Concrete slab and sloped hillside require planning (array size and position)

This area size of this site provides array-sizing flexibility. It is situated across the main Wharf road from the Town Hall. Highly visible to anyone leaving the Wharf area via the adjacent road, the site is unimposing and obstructs no views. Formerly the site of a timber frame clarifying plant, the structure was torn down during Department of Environmental Protection (DEP) remediation efforts concerning #2 heating oil contamination. After full remediation and resolution, the sloped land is unused and is covered with poison ivy and wildflowers (the Team did not experience poison ivy during testing). A small concrete slab remains.The Town of Long Island has established unimproved, long-term parking (compact dirt) at the base of the slope.

Financial calculations associated with Site 4 include several sizing options per land available. Sizes are 2.5 kW mounted on the concrete slab; 12.5 kW mounted on the concrete slab and running easterly across the slope; and 25 kW, same concrete mount and easterly run (two rows totaling 25 kW). The 25kW area (185 ft x 12 ft)

accommodates 100 solar panels, configured as 2 rows of 50 panels (25 kW at 250W/ panel). This system produces approximately 32,000 kWh per year at an installed cost of $3.30/W. Payback is in Year 13 with an IRR of 5.2% and net present value of $988 over 25 years. Ultimately, the Team proposes a 25 kW array, for which the most comprehensive financial analysis is prepared.

Site 5) Solar Canopy - Town Storage Parking

Ranking = 2

This site presented as an alternative to the shade experienced at Site 1 (Solar Canopy - Main Parking).

Merits include:

* Excellent solar exposure
* Zero view impact
* Potential electric vehicle charging station
* Potential revenue generation for covered parking
* No car canopy re-orientation and re-striping, given cars are single file and are facing 135 degrees (45 degrees shy of due south).

Challenges include:

* Cost of car canopy

Site 5 is located in front of a municipal storage building, from which the building and nearby trees pose no shade to the proposed car canopy. Sizing at this site is more suitable to net metering municipal electricity usage. The area outlined (90 ft x 20 ft) accommodates 120 solar panels, configured as 4 rows of 30 panels (30 kW at 250W/ panel). This system generates an estimated 30,000 kWh per year. Payback is in Year 23 with an IRR of 0.7% and NPV of $(24,307) over 25 years.

Financial calculations associated with Site 5 itemize a cost estimate for a solar canopy ($4.50/W installed, as quoted by Revision Energy and Carport Structures), solar potential at the site 12.1% capacity factor, as calculated from Solar Pathfinder data. See Appendix N (Solar Pathfinder Data and Analytical Findings), and additional financial assumptions (below), which result in a negative NPV. Some residents are interested in covered parking. It is possible that re-calculating the financials of this site with parking-revenue projections may make this site more financially feasible.

Conclusions

Site 4 is is the most financially sensible and is desirable for several reasons. It is public, without being visually obstructive. It utilizes an otherwise undesirable area. Ground mounts are cost effective, especially in comparison to a solar car canopy, which requires an additional mounting-structure. Also, ground mounts offer the easiest access for maintenance.

If it is possible to strategize finances for a positive NPV and reduced payback period, Site 5 has strong merit for construction and installation of a solar car canopy.

The introduction of an electric charging station for shore power to the Emergency Fire and Rescue vessel is feasible. As a goodwill gesture for the dozen electric golf-cart owners, it further exposes and incentivizes gas-powered golf-cart and vehicle owners to consider renewable-energy options. Further research is needed. It is an unlikely consideration that the community, as a whole, transitions to an e-car fleet, given current ‘Island car’ maintenance prioritization.

Community Feedback

On Saturday, November 8, 2014, the Team reconvened on Long Island for a second visit. Local-resource, Island-wide energy use, municipal-expense and site-assessment findings were presented to the community during a twenty-minute Keynote presentation at the Town library. Attendees included Nate Johnson, Kate Unkel, Luke Greco, Rebecca Coombs, Barbara Johnson, Dick Murphy, Curt Murley, David Johnson, Doug Grant, Karen Grant, Erin Love, Ralph Sweet, Meredith Sweet, Mark Greene, Tommy Hohn, Michael Johnson, Kay Johnson, Moira Johnson, Will Tierney, and about 6 children. Residents were generally supportive, curious about renewable technology and interested in next steps. Comments followed, including questions about:

* requirements to move from feasibility to implementation
* potential impacts on taxes (mil rate)

* concerns about wind

New questions brought to the table included:

* what are residential passive solar possibilities
* what resource support is available for individual/residential solar installations (site assessments)

A few attendees noted that the $26,000 electrical expenses for municipal buildings is a significant part of the town budget. Based on residents participation, the Team observed potential community supporters and advocates of future renewables' projects. They also noted ways of engaging residents through social media and meetings (community weekly newsletter, Facebook energy group page, etc.) to cultivate dialogue and discussion amongst community members as proposed renewable energy projects evolve. Exchanging ideas, questions and facts in person and through media serve to educate residents and build rapport.

After the presentation, the Team joined attendees in the VFW hall for the annual harvest dinner fundraiser for the community garden. Approximately 100+ residents attended (about half the winter population), with live music.

GATEWAY PROJECT - FINANCIALS AND FINANCING

Explanation of Key Concepts

Net Metering

All financial calculations assume that all electricity generated from renewable solar energy projects directly offsets municipal energy consumption, a scenario that requires net-metering. Net metering means that electricity generated will be credited against the owner's electricity bill – i.e., if you own a solar system on your roof that produces 300 kWh per month and you consume 500 kWh in the same month, you pay for 200 kWh for that month.

Important to note is that the climate for public utilities offering net-metering in Maine is controversial. The potential for this State-sanctioned solar incentive may shift. In conversations with utility employees, academic professors and State officials, it has been regularly suggested to implement solar projects associated with net metering 'sooner than later. Net metering may not last long term.'

Net-metering requires an Inter-connection Agreement with CMP, which is a multi-step process. Directions may be found on its website.[14] More specifics on the definition of net-metering may be found on the same website.[15]

Virtual Net-Metering

Virtual net-metering simply means that one electricity generator (i.e., solar array) can be linked to more than one utility account. This allows, for example, the Long Island municipality to link multiple municipal accounts to the same solar array. Also, this allows a scenario by which multiple people may take advantage of a credit on their individual utility bills from one jointly-owned solar array. This situation may prove beneficial if a community-supported and -scaled solar system is established on Long Island.

Renewable Energy Credits (RECs)

All financials calculations assume additional revenue from Renewable Energy Credits (RECs). RECs are credits attached to the electricity generated from certain renewable sources that may be sold in Maine, or in nearby states such as Massachusetts (higher values in MA). This study assumes a per kWh sale of $0.04.

Investment Tax Credit (ITC)

The financial assumptions on the above solar systems take into account the investment tax credit, which provides a tax credit to the solar-system owner at a value of 30% of the total system cost (costs of system, installation, etc.). Systems include photovoltaics and solar water heating systems. Currently this federal incentive is the most significant federal policy mechanism to support solar energy in the United States. Worth noting, in particular -- this solar incentive expires December 31, 2016. If residents consider solar projects on Long Island, it is advised that system installation occurs before the December 2016 deadline. Residential and commercial consumers are eligible. Municipal and non-profit entities may disregard these tax issues, given they are generally tax exempt. Entities without federal tax liabilities sometimes use third-party system owner arrangements to install solar since a third-party may take advantage of the solar investment tax credit, passing along some savings to the solar system host customer. IRS Investment Credit Form 3468 is available at www.irs.gov/formspubs Contact either tax preparers or tax attorneys for more information.

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[14] http://www.cmpco.com/YourAccount/puc324.html

[15] http://www.cmpco.com/SuppliersAndPartners/MainesElectricityMarket/BusinessInMaine/netenergymetering.html

Modified Accelerated Cost Recovery System (MACRS)

The above-mentioned solar systems have also incorporated MACRS – a federal incentive that allows solar-array owners to depreciate the value of their systems over 5 years. Properties with solar energy are eligible for depreciation. This results in investment recovery over a shorter time period, and thus a shorter payback. Certain geothermal, solar, and wind energy properties may be eligible for MACRS 5-year property depreciation using IRS federal Form 4562. Form 4562 is available at www.irs.gov/formspubs. US policy supporting renewables' tax credits and incentives under the Emergency Economic Stabilization Act includes the 110th Congress (2007-2008), House of Representatives Bill 1424, Division B: Energy Improvement and Extension Act of 2008[16]. Contact either tax preparers or tax attorneys for more information.

Potential Ownership Structures

Municipalities are not eligible for Tax Credits.

Important to note: Since municipalities do not pay federal taxes, they are unable to take advantage of the investment tax credit.

Special Purpose Entity Model (SPE Model)

The special purpose entity model allows municipalities to install solar systems and still take advantage of the ITC. A special purpose entity is a taxable entity that owns the solar system for the first x number of years until tax incentives are exhausted, after which the ownership returns to the non-taxable entity, i.e. the municipality, for the remaining life of the solar system. Such an arrangement is made with the municipality by a Power Purchasing Agreement (PPA). This model results in a significantly shorter payback than were a municipality to purchase the system without the assistance of any tax incentives. See Solar Energy Industries Association, *Third Party Solar Financing* http://www.seia.org/policy/finance-tax/third-party-financing

In such a relationship, the benefits are that the municipality incurs no upfront capital costs; energy pricing is predictable, and energy consumption cost savings begin accruing for the municipality. Additionally, fossil-fuel reliance is reduced, and the municipal and SPE demonstrate positive financial and environmental commitments.

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16 http://thomas.loc.gov/cgi-bin/bdquery/z?d110:HR01424:@@@L&summ2=m&

Statements to use of solar power, and carbon footprint reductions may, if associated with RECs' retentions, may be made. Potentially, local jobs in the renewable energy field may be created. Finally, community support is dynamic and variable -- open dialogue and thoughtful planning are key. Long Island residents have a history of rallying support, including secession, tax reductions by 30%, and library expansion and Community Center fundraising efforts.

The drawbacks involve identifying partners, determining appropriate renewable energy technology and prioritizing projects, and negotiating the SPE/municipality model structure. Once the SPE is formed, complex negotiations and potentially higher transaction costs result than if the municipality were buying the PV and/or wind system outright. Unexpected changes in PV system performance and/or access to the system may alter the contract. Involved parties must understand tradeoffs related to potential REC ownership/sale. Federal, state and local policy may change.

Local Special Purpose Entity

Another ownership option is a the formation of a local Special Purpose Entity with and by a local community member. Once formed, the local SPE may enter into a PPA with the municipality. Any economic benefit from a municipal solar installation remains in the community through mutual benefit to the municipality and the SPE. Similarly to the preceding model, the Special Purpose Entity may form a limited liability company (LLC) or a low-profit limited liability company (L3C). A very thorough explanation and examples of this model are detailed in *Guide to Community Solar Report*, written by the National Renewable Energy Laboratory, pages 14-20.[17] In this model, the local LLC or L3C is the Special Purpose Entity, Central Maine Power is the electric utility service, and the municipality is the host.

The benefits and drawbacks for the Local Special Purpose Entity are similar to those mentioned under the Special Purpose Entity Model, above. Potentially, social implications and reverberations have greater impact due to the 'local' and interdependent natures of Island living.

In review of the Maine Revised Statutes, Title 36: Community-Based Renewable Energy, Sections 3602-3609 describes community-based renewable energy. It appears Long Island may set up a variety of "Qualifying local owner," structures (individuals, municipalities, quasi-municipal corporations, schools, etc.) with at least 51% ownership in a locally owned electricity generating facility and which does not exceed 100 megawatts.

Another qualifying owner structure is "Program participant," which criteria, according to Section 3603, requires a 50 megawatt cap as the installed generating capacity for combined program participants, of which each participant may not exceed 10 megawatts. This program is eligible for a long-term contract and a REC multiplier. Under Section 3606 the value of the energy credit multiplier is 150% of amount of electricity

[17] http://www.nrel.gov/docs/fy11osti/49930.pdf

generated by a program participant, and are used in satisfying portfolio requirements (Section 3210.3 and .3A). Additional relevant ordinances and details are described in Appendix Q (Community-Scale Solar/Wind - Relevant Ordinances).

Listed below are the Assumptions used in making and justifying financial calculations, potential ownership structures and tested sites for solar-array installations.

Assumptions -- All Solar-Array Systems

Federal Incentives:
- 30% Federal Tax Credit *
- MACRs Depreciation *

* Assuming taxable entity

State Incentives:
- Net Metering

Local Incentives:
- Potential community-supported model

Electricity Rate for Town of Long Island:
$0.056 + 0.075603 /kWh = $0.1316/kWh[18]

Renewable Energy Credit Market value: $0.04/kWh
Customer Discount Rate (cost of financing): 5%

This rate reflects the hypothetical difference between present and future values of the same dollar amount. Often the discount rate is based on a few circumstantial characteristics, below. While the discount rate is clearly useful in financial analysis, determining the rate is extremely subjective and varies widely. Differing discount rate impacts on renewable energy projects is huge because of widespread variable rates.

1. Comparable investment or savings rate
2. Inflation rate
3. Risk tolerance

Other
- 25 year project life

[18] $0.075603/kWh listed as delivery rate on town municipal utility bills, $0.056 calculated as supply rate based on charge for supply rate and $ of kWh. There is some conflicting information with residential utility bills on Long Island as well as Maine's Public Utilities Commission website.

- 2% electricity annual adjustor[19]
- 0.05% annual degradation factor[20]
- Inverter replacement after 10 years

Funding Sources

* State of Maine Small Harbor Improvement Program (SHIP)
  http://www.maine.gov/mdot/pga/qcp/ship/,
  Requires 50% local match

* Department of Energy Loan Guarantee Program
  http://www.seia.org/policy/finance-tax/loan-guarantee-program

* US Government Advanced Energy Manufacturing Tax Credit (Section 48C)
  http://www.seia.org/policy/manufacturing-trade/solar-manufacturing-incentives
  Now expired, Solar Energy Industries Association continues advocacy for funding further projects.

* Solar Energy Industries Association, *Commence Construction Modification*
  http://www.seia.org/policy/finance-tax/commence-construction-modification
  Advocacy for full use of ITCs as well as the continuance of projects related to US Advanced Energy Manufacturing Tax Credit (Section 48)

* DSIRE - Database for State Incentives for Renewables & Efficiency (Maine)
  http://www.dsireusa.org/incentives/allsummaries.cfm?State=ME&&re=0&ee=0

Cost Breakdown of Each Solar Site

Cost per watt estimates derive from averaging a variety of sources. Notably, Revision Energy quoted their total install cost in the low/mid three dollar per watt range for roof mounts and ground mounts, respectively, and potentially up to, but no more than $4.50 per watt for a carport of their design. Conversely, Carport Structures quoted their install cost at approximately $1,600-1,800 per parking space, which adds around $1 per watt to the cost of these projects. However, this is offset by the lower cost of having panels mounted on an existing structure. It roughly evens out at the end. These prices are intended as a reference. Further cost analysis is recommended prior to the Town approving implementation of one or more of the solar-array projects.

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[19] Electricity Annual Adjustor: the percentage at which the price of electricity is expected to increase each year.

[20] Annual Degradation Factor: the percentage by which the energy production of the solar panels is expected to decrease each year.

SITE 1: SOLAR CANOPY - MAIN PARKING
Size: 67.5kW
Installed Cost: $4.5/W
- GE Online Solar Canopy Calculator for 'Mid-Tier'
- includes engineering, installation, etc.
- electric vehicle charging unit not included
Capacity Factor: 12.1%
Area: 90 ft x 45 ft
Panels: 270 -- 30 panels across, 9 panels high

SITE 2 - Wharf
Not analyzed for financial feasibility at this time

SITE 3
Not analyzed for financial feasibility at this time

SITE 4 OPTIONS (3):

SITE 4: GROUND MOUNT - LONG-TERM PARKING 2.5kW
(Concrete slab only)
Size: 2.5 kW
Cost: $3.3/W
Capacity Factor: 14.65%
Area: 17 ft x 14 ft
Panels: 10 -- 5 panels across, 2 rows high
(each panel measures 5’5’ long x 3’3” wide, area calculations adjusted for panel spacing)

SITE 4: GROUND MOUNT - LONG-TERM PARKING 12.5kW
(Concrete slab and running easterly)
Size: 12.5 kW
Cost: $3.3/W
Capacity Factor: 14.65%
Area: 86 ft x 12 ft
Panels: 50 -- 2 rows of 25

SITE 4: GROUND MOUNT - LONG-TERM PARKING 25kW
(Concrete slab and running easterly)
Size: 25 kW
Cost: $3.3/W
Capacity Factor: 14.65%
Area: 185 ft x 12 ft
Panels: 100 -- 2 rows of 50
See Appendix R (Financial Calculations and Spreadsheets)

SITE 5: SOLAR CANOPY TOWN STORAGE PARKING 30kW
Size: 30 kW
Installed Cost: $4.5/W
Capacity Factor: 12.1%
Area: 90 ft x 20 ft
Panels: 120 -- 4 rows of 30
See Appendix R (Financial Calculations and Spreadsheets)

ROAD MAP

Complementary Initiatives

Weatherization and Efficiency Measures - While this study focuses on the introduction of renewable energy projects, prioritizing and implementing energy-efficiency strategies go hand in hand with introducing renewables. Long Island project goals focus on the feasibility of utilizing solar and wind technologies to reduce the energy costs of municipal buildings. Either before or simultaneous to installing solar and wind projects, performing energy audits in municipal buildings is important. Weatherization and energy-efficiency measures are key to cutting energy waste, thereby maximizing renewables. Efficiency measures for buildings include energy audits, air sealing, insulation, heat pumps, lighting/LEDs, HVAC equipment (air conditioning and ventilation), variable-speed drives for air handlers, low-flow water valves, boiler and furnace retrofits, programmable thermostats, wood and pellet heaters, energy loans and more. Efficiency Maine offers a Prescriptive Incentives' program.

Preliminary energy notes were compiled during the Team's first trip to Long Island, indicating some efficiency needs in Long Island municipal buildings. The summary is below. For more detail See Appendix H (Long Island Municipal Buildings - Detailed Energy Notes Oct 2014)

Table IV: Long Island Municipal Buildings Energy Notes - Oct 2014*

Bldg/Spaces	Energy Comments
Town Hall	No insulation; 2 fuel tanks fuel/yr.; garages decrepit
Community Center	New design more energy efficient, same footprint; fundraising $150k private donor; $500k community donations
School	Apparent discrepancy in last year's heating costs. Roof scheduled to be replaced in the next five years which could potentially accommodate solar panels
Community Center Construction	Demolition of the former Community Center commenced spring 2015. Contract has been awarded to Benchmark Construction

*Revised May 2015

Storm window inserts - Since 2011 the Island Institute has been conducting workshops to build removable and reusable storm windows in eight communities. Volunteers from many islands have built storm window inserts and have developed requisite skills to bring insert projects back to their own communities. Sam Saltonstall, a resident on neighboring Peaks Island, is a knowledgeable resource. He has spearheaded this initiative on Peaks. To date he has helped build and install 1,000 window inserts. Reducing energy consumption and improving energy efficiency is imperative. The payback is less than one year. Savings equate to 1 gallon fuel oil for every square foot of storm window. That represents significant annual savings.

Street and Wharf Lights - Currently annual street and wharf lighting expenses account for half the municipal electric expenses. There are seven street lights located at Mariners' Wharf and one hundred street lights on Long Island. Wharf and street lighting total five light types attached to 30 ft wooden poles. These are sodium lamps:

Sodium Enclosed	50 watt
Sodium Enclosed	70 watt
Sodium Enclosed	150 watt
Sodium Cut Off	70 watt

Currently Long Island leases street and wharf lights from Central Maine Power (CMP). CMP charges $0.2053/kWh, approximately $0.08/kWh higher than the overall Island rate. Under a lease agreement, there is no net-metering scenario. According to CMP, lease lights do not utilize meters, rather they are tapped directly to CMP power lines. Therefore, they cannot be net metered.

However, there are many examples where businesses and municipalities use meters, and they own and maintain lights. In these cases, CMP issues a power bill like any other metered customer. Customers are billed for the usage behind the meter, whether lighting or anything else placed on the meter.

In the case of metered private lighting, net-metering scenarios are possible, however, Breanna Pierce, Key Account Manager at CMP, is not aware of them. Generally, when considering metered service, customers may attach anything they want to the lights.

Given the above, first, it is worthwhile to research current street-light technology to determine if current Long Island light types are most energy efficient. CMP offers the option of replacing existing lights with lower wattage lights. Researching the process, studying the Town's lighting needs and calculating any associated savings provides valuable data for analysis. If the Town contracted with CMP for lower wattage lights, a new 15-year contract starts. Additionally, it is necessary to research the possibility and feasibility of street-light ownership and to compare against leasing and metering structures in these scenarios. Communities like Santa Rosa, California, have successfully reduced street-light electrical consumption and expenses due to progressive rules and legislation, modeling another way for other communities.

Santa Rosa has effectively instituted efficiency measures, thus cutting costs. They have de-energized select street lights altogether, have turned off street lights for certain hours, have equipped poles with photocell timers, and have utilized motion detectors, all as cost-saving retrofits. On Long Island, under the current CMP lease, one viable option for cost reductions is to eliminate those less beneficial fixtures altogether. CMP simply removes them. Town employee Nancy Jordan advises that when Long Island seceded from Portland in 1993, the Town eliminated half the lit poles. Neither review nor monitoring has occurred in connection with potential street and wharf lights' cost reductions.

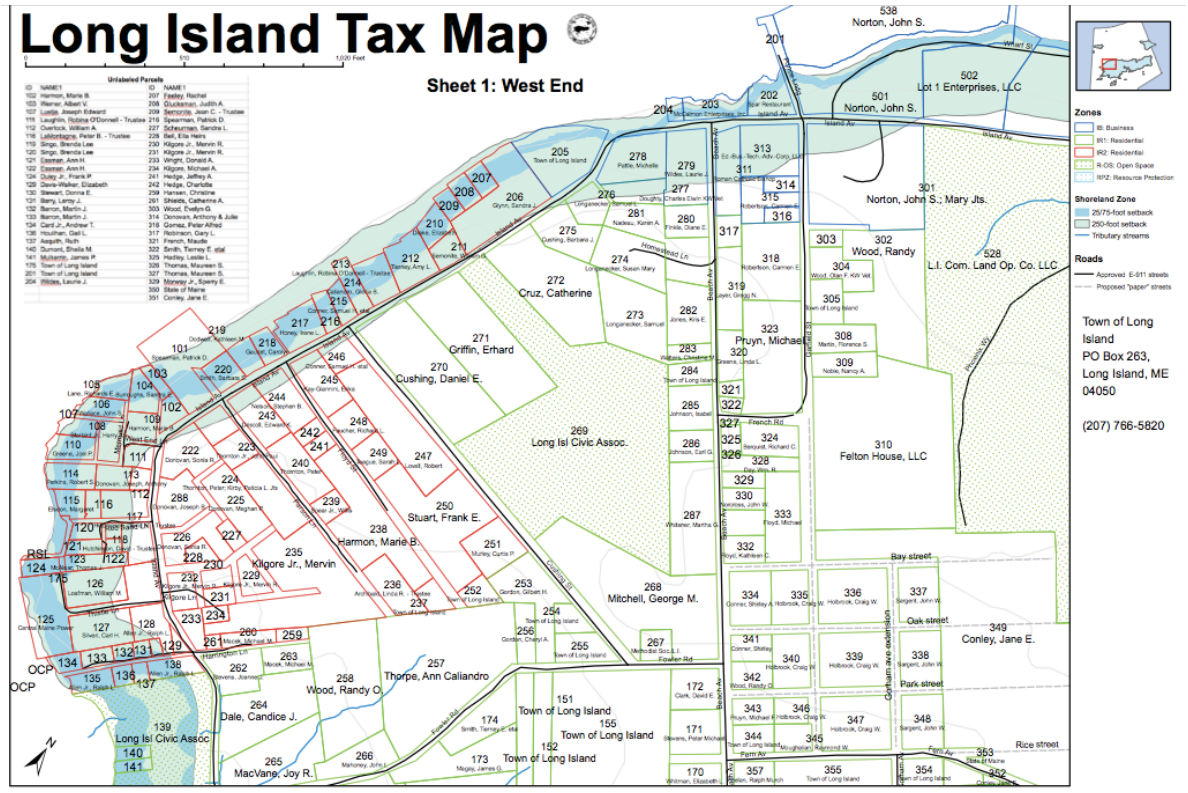
Potential Future Initiatives

Elementary school - Longstanding elementary school teacher, Paula Johnson, notes that the school roof is due for replacement in 2019. She envisions a roof-mounted solar array installation on the building's south-facing roof slope. Potential learning opportunities abound for students, theoretically and practically, by involving students in school energy assessment and installation processes. Paula expressed interest in curricula design involving energy, consumption, behavioral, and product conservation modification topics. The potential of a solar installation at the School offers additional electric generation to further offset municipal kWh usage.

Community-scale projects - Community-scale wind and solar are potential later-phase components for the Long Island renewable energy effort. These projects benefit multiple residents, and provide value as community-owned projects. At the outset, it is important to research cost-effective methods to monitor and determine a wind resource on Long Island. As stated earlier in this report, the Peaks Island study resulted in a marginal wind resource. To note, the meteorological tower reached 100 meters only. Further, it was not situated on the highest point. If solar or wind are individually and/or jointly considered for a second renewables project phase, potentially the Long Island transfer station is a viable site. Either an array and/or turbine may be erected on open land adjacent to the capped landfill. Three-phase power runs along the transfer station lot, offering ideal conditions to tie solar and/or wind electricity generation into the existent electrical grid.

Another site for a community-scale solar array is a-top the capped landfill. Capped in 1997, permissible time has elapsed to allow a solar project. At installation, concrete ballasts serve to anchor the array. This municipal lot is zoned as IR1 - residential - less dense. The lot is situated at the intersections of Cushing Street and Fowler Road (bottom center large block on map), as shown, below:

Map I: Long Island Tax Map



The location of this municipal land follows codes established in Town of Long Island Ordinances, Article 3, B. B. Permitted uses: The following uses are permitted in the IR-1 island residential zone (adopted May 4, 2002 and amended May 12, 2007):

(7) One detached accessory structure with a footprint less than one-hundred (100) square feet shall be permitted on each lot and shall be exempt from side and rear setbacks and shall be permitted without a building permit provided that the Town is notified by submitting a plot plan showing the location of the accessory structure on the property to be kept on file at Town Hall. (Adopted May 4, 2002)(Amended May 12, 2007) Also, an excerpt/summary of Article 59 in the Town of Long Island Ordinances about wind energy notes that *i*n May 2009 the Town of Long Island passed an ordinance for small wind energy conversion systems (SWECS) at Article 59 (page 23 begin).

Community wind and solar may be eligible for PACE loan financing, as established in Long Island's Property Assessed Clean Energy (PACE) Ordinance (adopted May 14, 2011), Chapter 16, Articles I-V.

Review of Maine Revised Statutes, Title 35A: The Maine Wind Energy Act, Sections 3401-3404 and Sections 3451-3459, offers regulatory guidelines about wind projects.

Section 3608.2 cites that publicly owned land, water and facilities are available to 'political subdivisions of the State' for development and operation (or lease to other qualifying owners) of renewable energy projects. Additional relevant ordinances and details are described in the Appendix Q (Community-Scale Solar/Wind - Relevant Ordinances), at the Town of Long Island Code of Ordinances[21] and the Maine State Legislature[22].

Over-production Social Model - Current financial calculations offset municipal expenses by closely sizing it to electricity usage. Theoretically, if solar electricity generation is greater than the usage of net-metered accounts, the Town of Long Island does not benefit from electricity overproduction. If important points are to maximize solar effciency and gains, to reduce fossil fuel dependency, etc., Long Island can raise the bar. If electric overproduction is feasible beyond offsetting municipal costs, Long Island may consider negotiating/gifting over-production of electricity to Town elders, the Portland school attended by Island children, etc. There are many social benefits, recipients and brainstorms to explore.

Business E-Car Fleet - The golf car rental business, located near the Town transfer station, may be incentivized to become a community leader in the Island conversion to renewable energy. As another option, the rental business may consider installing a solar array and charge station, thus becoming eligible for Property Assessed

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[21] http://townoflongisland.us/wp/?page_id=125

[22] www.mainelegislature.org/legis/statutes

Clean Energy (PACE) loan funding, as described in the Town of Long Island PACE Ordinance, Chapter 16, Articles I-V. Further research and analysis are necessary.

Renewable Energy Projects and Phases - Timeline

The tables, below, identify the main 2015 activities and phases to further the introduction and implementation of renewable energy projects on Long Island.

Table V: Long Island Timeline - 2015 Renewable Energy Activity

LONG ISLAND TIMELINE 2015 Renewable Energy Activity	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Feasibility Study submission to Nate	X											
Determine scope of Kate's involvement; review/revise study with Nate; establish projects and phases (see Table VI, below)		X										
Finalize solar-array system and sizing												
Identify community supporters and advocates for project components (finance, technology, social)												
Determine financial structure/model; identify funding and grant options; develop funding timeline												
Develop community outreach approach (Fbook energy group, article for town newsletter, releases, Town of Long Island website energy links, guides, etc.) and press schedule												
Prepare and meet with community to discuss proposed projects and phases; prepare proposal	X	X	X	X	X							

LONG ISLAND TIMELINE 2015 Renewable Energy Activity	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Present capital-improvement proposal at Town meeting			X									
Town meeting vote					X							
Implement and complete Phase I - Long Island Gateway Project												
Investment Tax Credit (solar tax credit of 30% on cost of system, installation, etc.) EXPIRES 2016												X
Revise, refine Long Island Gateway Project Phase I process towards Phase II												

Table VI: Long Island Renewable Energy Project Phases

Phase 1	Phase 2	Phase 3
Ground-mount solar array	Additional solar array(s)	Re-evaluate wind (test for resource)
Conservation audits and implementation: Town Hall, Fire Station, VFW, School, Transfer Station (on-site building), Community Center (currently designed green), Town street and dock lighting usage and need, Residential weatherization efforts (window inserts, heat pumps, behavioral, etc.)	Community-scale, -supported solar project (Transfer Station level area or capped landfill area)	Community -scale, -supported wind project (Transfer Station level area)

Phase 1	Phase 2	Phase 3
Funding research (philanthropy) for Wharf wind/solar demo/education project		

LONG ISLAND COMMUNITY - NEXT STEPS

* Submit Feasibility Study - This report has been academically evaluated by College of the Atlantic Faculty Anna Demeo and Jay Friedlander. Their feedback has been incorporated. During February 2015 the Study will be shared with Nathan Johnson and the Island Institute. This road map serves to inform and plan the social, technological and economic aspects of potential renewable energy projects on Long Island.

* Finalize the solar-array system and sizing, and associated financing structure/model.

* Determine the timeframe and scope of Kate's further involvement. Kate has expressed interest to Nathan, the Island Institute and Anna Demeo/Jay Friedlander (COA) about future work options regarding this project.

* Distribute the Feasibility Study to select Island residents for feedback and refinement as a community document (currently an academic document). Ultimately, a project proposal will be shared with Long Island community members at a public meeting. The intention of this iterative, community-based approach is to further refine the approach and potential for renewables' projects, while engendering rapport and trust with residents.

* Present a capital-improvement project proposal at March 2015 Town hearings. If prioritized, the proposal advances to the annual Town meeting in May 2015, at which time it is reviewed and put to a vote.

Development of the capital-improvement proposal for presentation at the March Town meeting is an important process, which first introduces the Gateway Project at a public municipal forum. Consideration to thoughtful, inclusive process include:

* Develop information-exchange platforms for future use by Island residents, which provide facts links, guides, etc., pertaining to energy consumption, conservation, and renewable energy transitions. These platforms may be introduced and maintained by community supporters and advocates. Platforms include a Facebook Long Island energy page, and energy-related facts/links to the Town of Long Island Maine 04050 FBook page (currently 748 members) and to the Town of Long Island website.

* Develop funding approach (determine avenues such as community donations, grants, LLC, developer, investors, etc.)
* Develop leadership approach to engage residents about participation; develop 'how-does-this-benefit-approachee/community' scenarios
* Identify and approach select supporters, advocates, municipality and potential partners
* Determine essential and consistent 'story' bullets for all key project planners;
* Cross all communication 't's and i's' before launching into public meeting phase
* Refine projects' timeline, post-Feasibility study (see Table V: Long Island Timeline - 2015 Renewable Energy Activity, above)
* Hold public meetings, as/when determined/needed
* Re-group, re-focus from meeting feedback/input. Listen, listen, listen. Refine, refine, refine.

IN APPRECIATION

Rebecca, Luke and Kate are greatly appreciative to College of the Atlantic, Anna Demeo, Jay Friedlander, Nick Urban, Island Institute, Fund for Maine Islands, Partridge Foundation, Samsø Energy Academy, Malene Lunden, Søren and Mads Hermansen, Nate Johnson, Barbara Johnson, Nancy Jordan, Barbara Johnson, Brenda Singo, Long Island potluck families (Sam and April Whitner, Lisa Kimball, etc.), "community baby Cora," Paula Johnson, Sean Rich, Mark Greene, Will Tierney, Bob Jordan, Harvest dinner community members (Dick Murphy, Ralph and Meredith Sweet, Curt Murley), Katie and Jonathan Norton (musicians), Keith Rose of Camden Regional High School, Riley, Natalie and Devon Johnson, the Town of Long Island, Tuck O'Brien and COA classmates from monster course *Islands: Energy, Economy and Community***.** This experience has been rich!

CONTACTS and RESOURCES

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Nathan Johnson	njohnson@orpc.co

College of the Atlantic	http://www.coa.edu
Island Institute	http://www.islandinstitute.org
Town of Long Island, Maine	http://townoflongisland.us

Cooperatives:

Rural Finance	Coastal Enterprises, Inc. http://www.ceimaine.org/financing/real-estate-financing/
	Cooperative Fund of New England http://www.cooperativefund.org/
	Island Employee Cooperative, Burnt Cove, ME (non-energy case study) http://community-wealth.org/content/small-island-big-cooperative

Regulations, Policies and Ordinances:

Governor's Energy Office	http://www.maine.gov/energy/initiatives/index.html
Efficiency Maine	Peter Eglinton, Director of Programs 207.213.4156
Public Utilities' Commission	http://www.maine.gov/mpuc/
Federal Energy Regulatory Commission	http://www.ferc.gov/
Maine Legislature	(www.mainelegislature.org/legis/statutes)
Town of Long Island	Ordinances http://townoflongisland.us/wp/?page_id=125

Wind:	Cliff Island Data weather station http://www.wunderground.com/personal-weather-station/dashboard?ID=KMECLIFF4

Vendors:

Revision Energy	Liberty, ME http://www.revisionenergy.com
Carport Structures Corporation	Oxford, MI

	http://www.carportstructures.com/
RainWise	Trenton, ME http://www.rainwise.com
Urban Green Energy	Hybrid Streetlamps (Sanya model) http://www.urbangreenenergy.com/products/sanya
Northwind	100 kW Wind Turbine http://www.northernpower.com/wp-content/uploads/2014/09/20141119-US-NPS100C-24-brochure-online.pdf
Ogin	100 kW Wind Turbine http://oginenergy.com/our-technology
OnGrid Solar	http://www.ongrid.net/index.php?page=papers_termsuse

Incentives:

IRS	MACRS http://www.irs.gov/publications/p946/ch04.html
US Government	Library of Congress, House of Representatives 110th Congress (2007-2008) Bill HR 1424, Division B
Solar Energy Industries Association	http://www.seia.org solar investment tax credits
Tax Incentives Assistance Program	http://www.energytaxincentives.org/
Database of State Incentives for Renewables and Efficiency	http://www.dsireusa.org

Case Studies:

Maine Wind

* Mars Hill Wind - 42MW capacity / completed March 2007 [produces over 127k (MWh)/yr] with 28 turbines/18,000 homes powered/48k tons CO2 offset
* Fox Islands, Vinalhaven
* Bull Hill Wind - 34 megawatt capacity, Hancock Wind Amendment approval - July 2013; application acceptance January 2013

* Bingham Wind application accepted - May 2013
* Canton Mountain proposal for 22 megawatt, 8 turbine wind generation facility application accepted - January 2012 to upgrade and construct roads and construct transformer station and operations/maintenance building 448' from tower base to top of extended blades
* Passadumkeag Wind Park grant of appeal/permit approved - August 2014
* Oakfield Wind Project, Aroostook County permitted - January 2012 50 turbines
* Record Hill Wind Project, Roxbury permitted - August 2009
* Rollins Wind Project, Penobscot County permitted April 2009 (60 megawatt)
* Saddleback Ridge Wind Project permitted October 2011
* Spruce Mountain Wind Project permitted October 2010
* Stetson Wind I and II (Danforth) 30,000 homes powered/73k tons CO2 offset
    - SW I 57MW capacity / Jan 2009 / 38 turbines
    - SW II 26MW capacity / Mar 2010 / 17 turbines

APPENDICES

A Summary - Samsø Experience

Samsø, situated in the Kattegat Sea, is in the center of a scribed circle around Denmark. It is about 44 square miles, and approximately 9 miles off the Jutland peninsula. Year-round island residents total 3,800, which population swells to 10,000 during summer months. Agriculture and tourism are the main industries. The Energy Academy, Samsø's hub for resources and research that pertain to energy achievements, draws approximately 5,500 yearly visitors to the island.

During three weeks of Fall term 2014, fifteen College of the Atlantic students and two faculty spent the first week on Samsø researching the mentality, locality and activity of Samsø residents (Samsingers), immersing themselves in the cultural fiber and spirit of Samsø's geography, its people and their daily living. Students traversed the island by bicycle, interviewing residents. Interviewees included retired teachers, realtors, organic and conventional farmers, retired European Union parliament representatives, tradespeople, entrepreneurs, finance committee chairs for community-supported wind turbines, etc. Students created ten-minute movies. These captured varied perspectives of Island living -- Samsø as a noted *Energy Island*, and the process, impacts and consequences of achieving negative-carbon-footprint status. This academic experience closely cohered the student community, as well as instilled a deep appreciation for and with the Island community. Further social coherence was reinforced by Energy Academy staff, who led regular group-process check-ins and instruction.

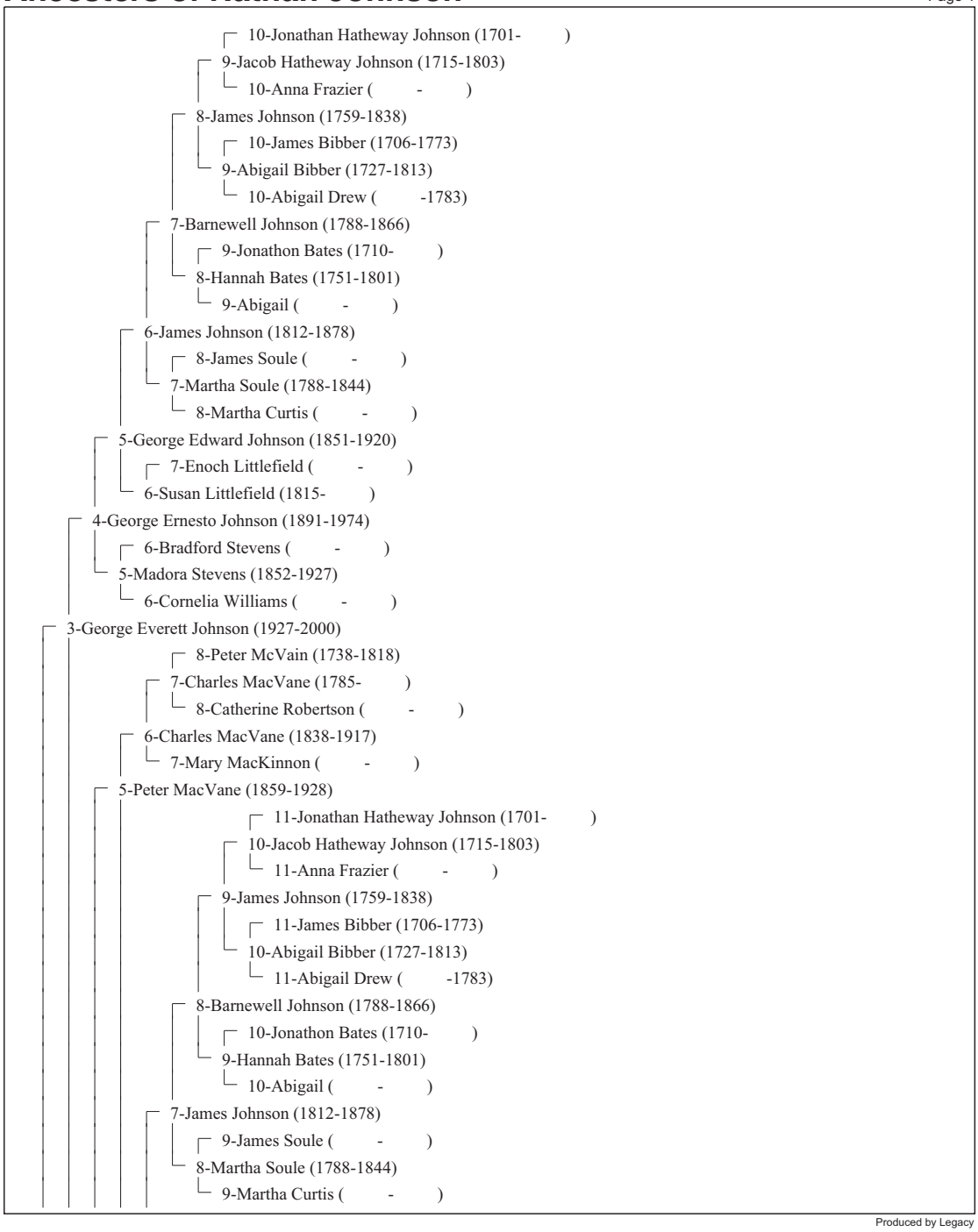
At the start of week two five Maine-island representatives and two Island Institute staff arrived. Islanders presented individual proposals, whereby students were assigned to particular Maine islands. Rebecca, Luke and Kate partnered with Nathan to discuss social, financial and technological aspects of the Samsø model relative to Long Island renewable-energy possibilities. The group learned about Long Island geography, demographics, history and industry, and how these factors contributed to Nathan's Gateway project concept proposal. Throughout the second and third weeks, integration (of first-week experience), lectures (process, technology and finance) and site visits (district heating, solar ground-mount/electric vehicle charge, municipal solar canopy, school, on- and off-shore wind turbines, etc.) proved invaluable to gaining deeper understanding of the similarities, differences, complexities and scope of the Samsø renewable energy project and how/what may be translated to planning and implementing projects on Long Island and in Maine.

Currently the Energy Academy is working on Samsø 2.0. Samsø 2.0 goals serve to transition the Island's transportation system to renewable energy and to become fossil-free. By 2050 gas and diesel vehicles will be replaced by electric cars, tractors, etc. November 2014 heralded the arrival of a municipally-owned ferry, which will be a hybrid replacement to a formerly fossil-fuel run ferry. The hybrid will be run by liquid generated

from biomass. Goals also include essential educational outreach, of which College of the Atlantic's extended (three-week) in-residence programming played an integral role in the development of an educational model for the Samsø Energy Academy.

B Johnson - Family Genealogy Chart

Ancesters of Nathan Johnson



Ancesters of Nathan Johnson

Ancesters of Nathan Johnson

1-Nathan Johnson (-)
└ 2-Paula Donovan (-)

C Community Visit to Long Island - October 2014

Rebecca Coombs, Lucas Greco and Kate Unkel traveled to Long Island in mid-October to tour the Island and to speak with residents about Island living. They participated in a dinner potluck with four young families. During the next morning they visited the Wharf store, where lobstermen gather daily over coffee. At Town Hall they made inquiries of Town employees Nancy Jordan, Barbara Johnson and Brenda Singo. They spoke with Sean Rich, a community lobsterman involved with deer-herd reduction, in efforts to reduce incidents of Lyme disease on the island. Later they met with Paula Johnson (teacher), Mark Greene (bulk-order heat pump community leader), Will Tierney (contractor and aquaponics' entrepreneur) and toured Nancy and Bob Jordan's passive solar home and gardens (1970s construction).

Outcome ~ Based on historical events, the Long Island Town website and conversations with a dozen Islanders, they spoke as:

* proud, independent and confident in influencing their destiny (Long Island became the first new town in Maine in 65 years with secession. Their taxes have gone down by 30%).

* active and strong in improving the quality of life for residents through volunteerism and participation (a successfully completed library expansion and an imminent community-center demolition and re-construction effort, with significant community donations enabling these projects).

* *In many ways these frugal habits and extensive volunteer activity help to create the wonderful sense of community that defines the Town of Long Island. We are very grateful to our able and committed volunteers. (*Town of Long Island 2008 Comprehensive Plan*).*

* nurturing towards their children. This Island children who attend Portland schools are excellent, well-prepared students, who transition smoothly from Island school. Also, the COA group met an infant at the first potluck. She was affectionately referred to as the 'community baby,' and was passed from one adult to the next throughout the evening, as well as at the November Harvest dinner community garden fundraiser).

* '*open to new ideas as long as they don't raise taxes*.' These words represented a persistent expression during interviews.

* identifying strongly with inter-generational families' and their legacies, which provide respect, deep knowledge, experiences and historical bases for life on the island. (*Nathan is well respected on this Island,* a sentiment expressed by several community members*)*

During conversations with residents, community themes and concerns emerged. These included:

* re-population, with an interest in new families and babies. School enrollment and grades'-configuration forecasts were projected, in some instances based on marriage and vacation dates of community members.

* self-sustaining food systems. Outlets include: food buying club, community garden, recycling. Innovations include: compost, anaerobic digester, aquaponics.

* education (teacher is open to energy curricula and activities for Grades 3-5. She notes that the school roof needs replacement in 2019 and mentions including solar panels at that time).

* elder care (*If they can't stay at home, then what? Many elders have fixed incomes)*

* health clinic. An island clinic is a necessary service.

* workers (0% unemployment rate, various construction/fishing jobs are unfilled)

* Lyme's disease. During the past few years more residents have been diagnosed positive. Nate has been treated twice. Currently the Town is reducing the herd size, using infrared cameras and tree platforms for shooters. All meat is processed and distributed to island families.

* tidal renewable energy. At Hussey Ledge surges reach 40' (Sean Rich)

* conservation efforts, including solar heat. A resident mentioned a DIY project by hollowing aluminum cans, painting them black, then stacking them inside a window for cool to warm heat transferral).

* knotweed, as an invasive species.

D Long Island Timeline Detail - 2014 COA Fall Term [draft]

LONG ISLAND ROADMAP PLANNING	Point Person	Due	Done	'Take Home'	Oct 13 - 19	Oct 20-26	Oct 27- Nov 2	Nov 3-9	Nov 10-16	Nov 17-23
Color Legend										
COA **Energy Assess** **Renewable Assess**										
Finance **Social/Admin** **Milestones**										
To Do										
Visit LIsland; conduct interviews	ALL	16-O	x							
Prepare COA update - write 1-2 pp and timeline; select 2-5 slides	RC/ LG/ KU	21-O	x	timeline draft						
Calculate annual energy costs (heat/electric)	NJ/KU	-	x	$19K over-budget = 1/3 of overall over-budget figure ($60K)						
Calculation: Total Energy Consumption - Potential Energy Savings from Retrofits = Total Energy Production Need (kWh)	NJ/KU			A. PWorks 7%; VFW 4%; Police 8%; Trans. Stat. 5%; Fire 28%; Town Hall 7%; Water 7%; ComCenter 9%; Wharf 25% of total energy needs in 2013-14 (49,012 kWh/ annual). B. Fire Dept. Wharf consumption highest. Nov/Dec-May peak months. C. Annual consumption of 49,012 kWh usage in 2013-14 informs technology needs, budgets and returns on investment.						

LONG ISLAND ROADMAP PLANNING	Point Person	Due	Done	'Take Home'	Oct 13 - 19	Oct 20-26	Oct 27-Nov 2	Nov 3-9	Nov 10-16	Nov 17-23
Assess solar sites (pathfinder/ program analysis)	LG/ KU	21-O	x							
Determine potential wind sites	All	-	x	phase 1 - wharf phase 2 - near landfill						
Research/install anemometers; determine test-time duration	LG									
Research wind/solar equipment options (including estimating kW capacities and physical sizes)	LG/NJ		x							
Review and analyze existent wind data per email - Unity College, Mick Womersley	MW		x							
Access, then review Community Center design plans (at least square footage)	NJ									
Confirm estimated system costs for proposed system	NJ/LG	24-O	x							
Research federal, state regulations and municipal zoning ordinances	KU	27-O	x							
Preliminary comparison of economics on discussed projects (i.e., Mariner's Wharf Gateway project, communtiy-scale wind and solar, etc.)	RC/ LG/ KU	27-O	x							
Preliminary options/proposals on financing and ownership models for projects	RC/ LG/ KU	3-Nov	x							
Attend class - speakers Tim and Tuck	All	21-O	x							
Prepare SHE conference (Society of Human Ecology) COA - 8am	RC/ LG/ KU	23-O	x							
SHE conference	RC/ LG/ KU	24-O	x							
SHE conference - COA	RC/ LG/ KU	25-O	x							
Attend class - debrief Malene and Søren	RC/ LG/ KU	27-O	x							
Attend class - speaker Suzanne	RC/ LG/ KU	31-O	x							
Write COA blog entries	RC/ LG/ KU	3-Nov								
Attend IInstitute Energy conference	ALL	7-Nov	x							
Attend IInstitute Energy conference - Peaks		8-Nov	x							

LONG ISLAND ROADMAP PLANNING	Point Person	Due	Done	'Take Home'	Oct 13 - 19	Oct 20-26	Oct 27- Nov 2	Nov 3-9	Nov 10-16	Nov 17-23
Outline project comparisons in prep for community meeting - criteria 1. economic; 2. technical; 3. social; 4. overall timeline	ALL combined	6-Nov	x							
Prepare community meeting for LIsland visit	ALL	6-Nov	x							
MILESTONE: Visit LIsland for community meeting to gather ideas/input on options	ALL	**8-Nov**	x							
Post energy update in LIsland newsletter										
Research further as follow up to community feedback/ suggestions										
Set up social media energy tool for LIsland residents (fbook, website?)		10-No								
Attend class - speaker Peter Davidson, US DoE		13-No								
Develop detailed financial pro-formas for phase I project	RC	17-No								
Develop detailed financial strategy/plan for phase I project	RC	17-No								
Present Final Presentations - COA, 9-12	RC/ LG/ KU	17-No								
Draft Feasibility Study/Written Roadmap	ALL	18-No								
Develop financial analysis for phase II project, and potentially for other roadmap projects	RC	19-No								
Complete Feasibility Study/ Written Roadmap	ALL	21-No								
MILESTONE: Meet with LIsland community members to discuss/present findings	ALL									

E Calculations of CMP Data - LI Whole Island from Jan 1 - Nov 10, 2014 (including individual use)

	A	B	C	D	E	F	G	H
1								
2			**LONG ISLAND ENERGY USAGE DATA - 2014**					
3			**Month**	**Energy Usage (kWh**				
4			January	134,615		**ISLAND ENERGY USE**		
5			February	109,468		Electricity Usage per Month	134,229	
6			March	117,103		Total Year (est.)	1,610,751	
7			April	102,318		(- 5% line loss)	1,530,214	
8			May	116,392				
9			June	128,574				
10			July	187,103				
11			August	183,299		**MUNICIPAL BUILDINGS ENERGY USE**		
12			Septembe	135,430		Electricity Usage - 1 Year	121,576	
13			October	127,992		As %age of Island Usage	7.9%	
14			November					
15			December					
16			**Total**	**1,342,293**				
17						**HOUSEHOLD ENERGY USE**		
18						# of year-round residents	230	
19						# of households	99	
20						non-municipal usage (January)	123,920	
21						electricity usage / person (Jan)	538.78	
22						electricity usage / household (Jan)	1,252	
23						average kWh/household in Maine (Jan)	530	(700-800 according to Anna)

Energy Usage data from CMP

Usage_Day	Usage			
1/1/14	4811.8			
1/2/14	5244.6			
1/3/14	5774.1			
1/4/14	5278.5			
1/5/14	4473.7			
1/6/14	3962.1			
1/7/14	4570.4			
1/8/14	4920.6			
1/9/14	4606.2			
1/10/14	4452.3			
1/11/14	4317.4			
1/12/14	3620.5			
1/13/14	3447.2			
1/14/14	3510.0			
1/15/14	3278.7			
1/16/14	3629.8			
1/17/14	3426.2			
1/18/14	3811.1			
1/19/14	3702.0			
1/20/14	3836.3			
1/21/14	4497.3			
1/22/14	5089.3			
1/23/14	4852.0			
1/24/14	4820.7			
1/25/14	4688.3			
1/26/14	4455.1			
1/27/14	4297.4			

1/28/14	4498.9			
1/29/14	4459.8			
1/30/14	4297.2			
1/31/14	3985.4			
2/1/14	3906.7			
2/2/14	3750.2			
2/3/14	3615.1			
2/4/14	3784.4			
2/5/14	4204.1			
2/6/14	4059.9			
2/7/14	4039.6			
2/8/14	4076.5			
2/9/14	4008.2			
2/10/14	4050.0			
2/11/14	4032.5			
2/12/14	4173.8			
2/13/14	4233.0			
2/14/14	3796.1			
2/15/14	3725.7			
2/16/14	3861.3			
2/17/14	4118.0			
2/18/14	4250.7			
2/19/14	3964.7			
2/20/14	3529.8			
2/21/14	3618.6			
2/22/14	3425.5			
2/23/14	3355.8			
2/24/14	3543.5			
2/25/14	3935.2			
2/26/14	4109.6			
2/27/14	4123.7			
2/28/14	4175.8			
3/1/14	4300.9			
3/2/14	3956.6			
3/3/14	4295.8			
3/4/14	4283.3			
3/5/14	4385.0			
3/6/14	4322.7			
3/7/14	3805.7			
3/8/14	3478.5			
3/9/14	3334.7			
3/10/14	3410.5			
3/11/14	3264.9			
3/12/14	3376.3			
3/13/14	4166.3			
3/14/14	3853.3			
3/15/14	3478.8			
3/16/14	3798.7			
3/17/14	4064.9			
3/18/14	3899.1			
3/19/14	3717.5			
3/20/14	3375.7			
3/21/14	3208.8			

3/22/14	3873.0			
3/23/14	3771.4			
3/24/14	3999.7			
3/25/14	3826.6			
3/26/14	4091.1			
3/27/14	3947.3			
3/28/14	3504.9			
3/29/14	3139.9			
3/30/14	3525.7			
3/31/14	3645.0			
4/1/14	3356.9			
4/2/14	3393.3			
4/3/14	3192.9			
4/4/14	3125.3			
4/5/14	3394.9			
4/6/14	3145.9			
4/7/14	3083.2			
4/8/14	3243.8			
4/9/14	3123.6			
4/10/14	3347.7			
4/11/14	3190.0			
4/12/14	2952.6			
4/13/14	3583.5			
4/14/14	3047.1			
4/15/14	3015.5			
4/16/14	3494.8			
4/17/14	3775.6			
4/18/14	3954.5			
4/19/14	4105.1			
4/20/14	3695.4			
4/21/14	3435.8			
4/22/14	3185.4			
4/23/14	3135.9			
4/24/14	3209.6			
4/25/14	3296.6			
4/26/14	4021.9			
4/27/14	4000.8			
4/28/14	3523.3			
4/29/14	3482.4			
4/30/14	3804.7			
5/1/14	3664.9			
5/2/14	3203.9			
5/3/14	3724.7			
5/4/14	3720.0			
5/5/14	3229.0			
5/6/14	3062.9			
5/7/14	2939.5			
5/8/14	3049.6			
5/9/14	3614.3			
5/10/14	4007.7			
5/11/14	3224.0			
5/12/14	2794.0			
5/13/14	2997.1			

5/14/14	3401.4			
5/15/14	3251.5			
5/16/14	3246.3			
5/17/14	4037.7			
5/18/14	3898.3			
5/19/14	3501.9			
5/20/14	3265.4			
5/21/14	3034.0			
5/22/14	3504.4			
5/23/14	4653.1			
5/24/14	5580.2			
5/25/14	5835.9			
5/26/14	5230.5			
5/27/14	4004.5			
5/28/14	4126.3			
5/29/14	3881.9			
5/30/14	4054.3			
5/31/14	4652.7			
6/1/14	4482.3			
6/2/14	3615.2			
6/3/14	3509.6			
6/4/14	4082.2			
6/5/14	3992.9			
6/6/14	3882.7			
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6/12/14	3748.9			
6/13/14	4511.9			
6/14/14	4890.4			
6/15/14	4441.8			
6/16/14	3804.2			
6/17/14	3635.8			
6/18/14	3797.0			
6/19/14	3944.0			
6/20/14	4221.4			
6/21/14	4897.8			
6/22/14	5031.8			
6/23/14	4289.3			
6/24/14	4194.4			
6/25/14	4157.3			
6/26/14	4321.0			
6/27/14	4578.3			
6/28/14	5470.8			
6/29/14	5722.3			
6/30/14	5545.0			
7/1/14	5742.6			
7/2/14	6271.1			
7/3/14	7174.7			
7/4/14	8335.9			
7/5/14	8105.1			

7/6/14	7106.5			
7/7/14	6106.3			
7/8/14	5722.1			
7/9/14	5644.4			
7/10/14	5329.7			
7/11/14	5634.0			
7/12/14	6161.2			
7/13/14	6201.4			
7/14/14	5560.6			
7/15/14	5374.7			
7/16/14	5631.2			
7/17/14	5481.8			
7/18/14	5703.9			
7/19/14	6352.5			
7/20/14	6593.2			
7/21/14	5623.4			
7/22/14	5604.3			
7/23/14	5683.2			
7/24/14	5761.7			
7/25/14	5952.5			
7/26/14	6436.3			
7/27/14	6468.1			
7/28/14	5877.9			
7/29/14	4264.1			
7/30/14	5450.6			
7/31/14	5747.6			
8/1/14	5965.6			
8/2/14	6450.1			
8/3/14	6400.2			
8/4/14	5717.2			
8/5/14	5639.2			
8/6/14	5575.4			
8/7/14	5569.4			
8/8/14	6062.7			
8/9/14	6740.6			
8/10/14	6668.6			
8/11/14	5947.3			
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8/13/14	6040.9			
8/14/14	5775.9			
8/15/14	6428.9			
8/16/14	6558.4			
8/17/14	6794.9			
8/18/14	5486.7			
8/19/14	5356.4			
8/20/14	5481.7			
8/21/14	5539.8			
8/22/14	5935.2			
8/23/14	6295.7			
8/24/14	5992.7			
8/25/14	5301.1			
8/26/14	5083.9			
8/27/14	5111.9			

8/28/14	5209.2			
8/29/14	5520.3			
8/30/14	6405.8			
8/31/14	6488.2			
9/1/14	5913.4			
9/2/14	4732.3			
9/3/14	4510.3			
9/4/14	4448.6			
9/5/14	4799.2			
9/6/14	5381.1			
9/7/14	5124.1			
9/8/14	4004.5			
9/9/14	4153.1			
9/10/14	4170.6			
9/11/14	4179.5			
9/12/14	4412.3			
9/13/14	5244.9			
9/14/14	5000.4			
9/15/14	4438.1			
9/16/14	4388.8			
9/17/14	4148.4			
9/18/14	4253.3			
9/19/14	4800.7			
9/20/14	5695.7			
9/21/14	4806.5			
9/22/14	3914.8			
9/23/14	3898.8			
9/24/14	3983.9			
9/25/14	3988.9			
9/26/14	4171.0			
9/27/14	4597.0			
9/28/14	4465.2			
9/29/14	3981.4			
9/30/14	3822.8			
10/1/14	3890.4			
10/2/14	3914.6			
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10/4/14	4981.9			
10/5/14	4320.9			
10/6/14	3928.3			
10/7/14	3857.6			
10/8/14	3624.7			
10/9/14	3710.6			
10/10/14	4326.3			
10/11/14	6336.4			
10/12/14	5855.6			
10/13/14	5185.9			
10/14/14	3769.2			
10/15/14	3559.1			
10/16/14	3613.4			
10/17/14	3742.2			
10/18/14	4293.3			
10/19/14	4606.4			

10/20/14	4183.0			
10/21/14	3840.5			
10/22/14	3811.4			
10/23/14	4042.3			
10/24/14	4009.7			
10/25/14	4176.1			
10/26/14	4091.0			
10/27/14	3650.1			
10/28/14	3746.4			
10/29/14	3536.1			
10/30/14	3523.9			
10/31/14	3595.8			
11/1/14	4329.8			
11/2/14	4715.9			
11/3/14	4005.0			
11/4/14	3718.5			
11/5/14	3212.8			
11/6/14	3344.5			
11/7/14	3816.1			
11/8/14	4224.4			
11/9/14	3786.9			

F Calculations for Long Island Municipal Energy Usage Breakdown 2013-2014

(a) Breakdown by account

	A	B	C	D	E	F	G	H	I	J	K
1		Energy Expenses Jul '13 - Jun 14	$		Electricity Usage Onl	$	total kWh	%	8 accounts (for net-metering)		
2	5100-04 · Heat-Govt		1,834.83								
3	5100-06 · Electricity-Govt		616.45		Town Hall	616.45	4,684	4%		4684	4%
4	5130-02 · Street Lights		13,889.63		Street Lights	13,889.63	38,037	31%			
5	5130-08 · Electricity-Waiting Room		0.00								
6	5130-10 · Electricity-Well Pump		509.94		Water Dept	509.94	3,875	3%		3875	3%
7	5130-12 · Electricity-Wharf		1,736.74		Wharf	1,736.74	4,822	4%			
8	5130-16 · Electricity VFW Bldg		465.49		VFW	465.49	3,537	3%		3537	3%
9	5317-18 · School Electricity		4,603.89		School	4,603.89	34,984	29%			
10	5317-20 · School Heat		22,074.55								
11	5200-05 · Town Boat Gas and Oil		2,614.15								
12	5420-02 · Heat-Police Bldg		0.00								
13	5420-06 · Electric-Police Bldg		540.84		Police	540.84	4,110	3%		4110	3%
14	5430-05 · Fire-Heating Oil		6,573.99								
15	5430-06 · Fire-Electric		1,910.90		Fire Dept	1,910.90	14,521	12%		14521	12%
16	5560-01 · Solid Waste-Electric		461.60		Transfer Station	461.60	3,508	3%		3508	3%
17	5630-01 · PW-Electricity		573.05		Public Works	573.05	4,354	4%		4354	4%
18	5630-04 · PW-Heating Oil		1,352.98								
19	5780-10 · CC-Electricity		677.01		Comm Center	677.01	5,144	4%		5144	4%
20	5780-50 · CC-Heat		0.00								
21	TOTAL		60,436.04		Total	25,985.54	121,576	100%		43,733	36%

(b) Town energy cost assumptions

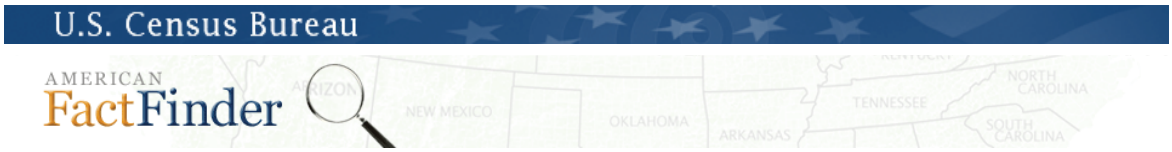
(prices reflected in all calculations)

Assumptions	
$/kWh - all accounts (including Street Lights and Electricity -Wharf, G4 and G7, above)	$0.1316

(c) CMP Data: Individual energy usage

(see above, Calculations of CMP Data - LI Whole Island from Jan 1 - Nov 10, 2014 [including individual use])

G 2008-2012 US Census Community Survey 5-Year Estimates



DP04 | SELECTED HOUSING CHARACTERISTICS

2008-2012 American Community Survey 5-Year Estimates

Supporting documentation on code lists, subject definitions, data accuracy, and statistical testing can be found on the American Community Survey website in the Data and Documentation section.

Sample size and data quality measures (including coverage rates, allocation rates, and response rates) can be found on the American Community Survey website in the Methodology section.

Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, it is the Census Bureau's Population Estimates Program that produces and disseminates the official estimates of the population for the nation, states, counties, cities and towns and estimates of housing units for states and counties.

Subject	ZCTA5 04050			
	Estimate	Margin of Error	Percent	Percent Margin of Error
HOUSING OCCUPANCY				
Total housing units	482	+/-62	482	(X)
Occupied housing units	153	+/-34	31.7%	+/-6.8
Vacant housing units	329	+/-59	68.3%	+/-6.8
Homeowner vacancy rate	8.1	+/-9.4	(X)	(X)
Rental vacancy rate	0.0	+/-39.0	(X)	(X)
UNITS IN STRUCTURE				
Total housing units	482	+/-62	482	(X)
1-unit, detached	468	+/-61	97.1%	+/-2.5
1-unit, attached	8	+/-7	1.7%	+/-1.5
2 units	0	+/-10	0.0%	+/-4.6
3 or 4 units	6	+/-10	1.2%	+/-2.1
5 to 9 units	0	+/-10	0.0%	+/-4.6
10 to 19 units	0	+/-10	0.0%	+/-4.6
20 or more units	0	+/-10	0.0%	+/-4.6
Mobile home	0	+/-10	0.0%	+/-4.6
Boat, RV, van, etc.	0	+/-10	0.0%	+/-4.6
YEAR STRUCTURE BUILT				
Total housing units	482	+/-62	482	(X)
Built 2010 or later	0	+/-10	0.0%	+/-4.6
Built 2000 to 2009	59	+/-44	12.2%	+/-8.6
Built 1990 to 1999	35	+/-17	7.3%	+/-3.6
Built 1980 to 1989	35	+/-19	7.3%	+/-4.0
Built 1970 to 1979	40	+/-20	8.3%	+/-4.3
Built 1960 to 1969	4	+/-6	0.8%	+/-1.3
Built 1950 to 1959	16	+/-16	3.3%	+/-3.2
Built 1940 to 1949	12	+/-9	2.5%	+/-1.8
Built 1939 or earlier	281	+/-52	58.3%	+/-8.0
ROOMS				
Total housing units	482	+/-62	482	(X)
1 room	0	+/-10	0.0%	+/-4.6
2 rooms	14	+/-12	2.9%	+/-2.5

Subject	ZCTA5 04050			
	Estimate	Margin of Error	Percent	Percent Margin of Error
3 rooms	36	+/-19	7.5%	+/-4.0
4 rooms	98	+/-53	20.3%	+/-10.0
5 rooms	160	+/-37	33.2%	+/-7.9
6 rooms	65	+/-23	13.5%	+/-5.1
7 rooms	66	+/-45	13.7%	+/-8.8
8 rooms	27	+/-16	5.6%	+/-3.3
9 rooms or more	16	+/-13	3.3%	+/-2.7
Median rooms	5.1	+/-0.3	(X)	(X)
BEDROOMS				
Total housing units	482	+/-62	482	(X)
No bedroom	0	+/-10	0.0%	+/-4.6
1 bedroom	63	+/-25	13.1%	+/-5.0
2 bedrooms	135	+/-55	28.0%	+/-10.0
3 bedrooms	218	+/-56	45.2%	+/-10.3
4 bedrooms	59	+/-23	12.2%	+/-4.7
5 or more bedrooms	7	+/-6	1.5%	+/-1.3
HOUSING TENURE				
Occupied housing units	153	+/-34	153	(X)
Owner-occupied	113	+/-27	73.9%	+/-11.3
Renter-occupied	40	+/-21	26.1%	+/-11.3
Average household size of owner-occupied unit	2.19	+/-0.24	(X)	(X)
Average household size of renter-occupied unit	1.58	+/-0.43	(X)	(X)
YEAR HOUSEHOLDER MOVED INTO UNIT				
Occupied housing units	153	+/-34	153	(X)
Moved in 2010 or later	2	+/-5	1.3%	+/-3.3
Moved in 2000 to 2009	63	+/-25	41.2%	+/-12.0
Moved in 1990 to 1999	47	+/-17	30.7%	+/-9.6
Moved in 1980 to 1989	24	+/-11	15.7%	+/-7.9
Moved in 1970 to 1979	7	+/-8	4.6%	+/-5.0
Moved in 1969 or earlier	10	+/-9	6.5%	+/-5.2
VEHICLES AVAILABLE				
Occupied housing units	153	+/-34	153	(X)
No vehicles available	17	+/-13	11.1%	+/-7.9
1 vehicle available	50	+/-22	32.7%	+/-12.1
2 vehicles available	61	+/-19	39.9%	+/-11.5
3 or more vehicles available	25	+/-17	16.3%	+/-9.6
HOUSE HEATING FUEL				
Occupied housing units	153	+/-34	153	(X)
Utility gas	2	+/-4	1.3%	+/-2.7
Bottled, tank, or LP gas	8	+/-7	5.2%	+/-4.6
Electricity	0	+/-10	0.0%	+/-13.6
Fuel oil, kerosene, etc.	113	+/-30	73.9%	+/-11.7
Coal or coke	1	+/-3	0.7%	+/-1.9
Wood	25	+/-17	16.3%	+/-10.4
Solar energy	0	+/-10	0.0%	+/-13.6
Other fuel	4	+/-5	2.6%	+/-3.4
No fuel used	0	+/-10	0.0%	+/-13.6
SELECTED CHARACTERISTICS				
Occupied housing units	153	+/-34	153	(X)
Lacking complete plumbing facilities	10	+/-10	6.5%	+/-6.1
Lacking complete kitchen facilities	12	+/-10	7.8%	+/-6.5
No telephone service available	7	+/-7	4.6%	+/-4.4

Subject	ZCTA5 04050			
	Estimate	Margin of Error	Percent	Percent Margin of Error
OCCUPANTS PER ROOM				
Occupied housing units	153	+/-34	153	(X)
1.00 or less	153	+/-34	100.0%	+/-13.6
1.01 to 1.50	0	+/-10	0.0%	+/-13.6
1.51 or more	0	+/-10	0.0%	+/-13.6
VALUE				
Owner-occupied units	113	+/-27	113	(X)
Less than $50,000	0	+/-10	0.0%	+/-18.0
$50,000 to $99,999	0	+/-10	0.0%	+/-18.0
$100,000 to $149,999	13	+/-12	11.5%	+/-10.5
$150,000 to $199,999	6	+/-6	5.3%	+/-5.5
$200,000 to $299,999	41	+/-20	36.3%	+/-14.5
$300,000 to $499,999	32	+/-13	28.3%	+/-11.0
$500,000 to $999,999	15	+/-12	13.3%	+/-10.2
$1,000,000 or more	6	+/-6	5.3%	+/-5.6
Median (dollars)	290,800	+/-43,171	(X)	(X)
MORTGAGE STATUS				
Owner-occupied units	113	+/-27	113	(X)
Housing units with a mortgage	66	+/-24	58.4%	+/-13.8
Housing units without a mortgage	47	+/-17	41.6%	+/-13.8
SELECTED MONTHLY OWNER COSTS (SMOC)				
Housing units with a mortgage	66	+/-24	66	(X)
Less than $300	0	+/-10	0.0%	+/-28.2
$300 to $499	0	+/-10	0.0%	+/-28.2
$500 to $699	2	+/-5	3.0%	+/-7.7
$700 to $999	11	+/-12	16.7%	+/-17.6
$1,000 to $1,499	9	+/-7	13.6%	+/-10.5
$1,500 to $1,999	17	+/-15	25.8%	+/-18.6
$2,000 or more	27	+/-12	40.9%	+/-17.0
Median (dollars)	1,864	+/-442	(X)	(X)
Housing units without a mortgage	47	+/-17	47	(X)
Less than $100	0	+/-10	0.0%	+/-35.7
$100 to $199	0	+/-10	0.0%	+/-35.7
$200 to $299	8	+/-7	17.0%	+/-14.2
$300 to $399	11	+/-9	23.4%	+/-14.4
$400 or more	28	+/-13	59.6%	+/-14.8
Median (dollars)	456	+/-77	(X)	(X)
SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME (SMOCAPI)				
Housing units with a mortgage (excluding units where SMOCAPI cannot be computed)	66	+/-24	66	(X)
Less than 20.0 percent	16	+/-13	24.2%	+/-18.1
20.0 to 24.9 percent	3	+/-4	4.5%	+/-7.2
25.0 to 29.9 percent	0	+/-10	0.0%	+/-28.2
30.0 to 34.9 percent	5	+/-5	7.6%	+/-8.1
35.0 percent or more	42	+/-20	63.6%	+/-18.0
Not computed	0	+/-10	(X)	(X)
Housing unit without a mortgage (excluding units where SMOCAPI cannot be computed)	47	+/-17	47	(X)
Less than 10.0 percent	16	+/-10	34.0%	+/-20.1
10.0 to 14.9 percent	6	+/-5	12.8%	+/-10.5
15.0 to 19.9 percent	11	+/-9	23.4%	+/-15.8

Subject	ZCTA5 04050			
	Estimate	Margin of Error	Percent	Percent Margin of Error
20.0 to 24.9 percent	5	+/-6	10.6%	+/-12.2
25.0 to 29.9 percent	0	+/-10	0.0%	+/-35.7
30.0 to 34.9 percent	5	+/-7	10.6%	+/-13.7
35.0 percent or more	4	+/-4	8.5%	+/-8.5
Not computed	0	+/-10	(X)	(X)
GROSS RENT				
Occupied units paying rent	15	+/-11	15	(X)
Less than $200	0	+/-10	0.0%	+/-63.7
$200 to $299	0	+/-10	0.0%	+/-63.7
$300 to $499	1	+/-2	6.7%	+/-14.2
$500 to $749	3	+/-5	20.0%	+/-31.8
$750 to $999	6	+/-7	40.0%	+/-35.9
$1,000 to $1,499	0	+/-10	0.0%	+/-63.7
$1,500 or more	5	+/-6	33.3%	+/-33.8
Median (dollars)	958	+/-386	(X)	(X)
No rent paid	25	+/-18	(X)	(X)
GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME (GRAPI)				
Occupied units paying rent (excluding units where GRAPI cannot be computed)	15	+/-11	15	(X)
Less than 15.0 percent	0	+/-10	0.0%	+/-63.7
15.0 to 19.9 percent	3	+/-5	20.0%	+/-30.5
20.0 to 24.9 percent	0	+/-10	0.0%	+/-63.7
25.0 to 29.9 percent	3	+/-5	20.0%	+/-31.8
30.0 to 34.9 percent	0	+/-10	0.0%	+/-63.7
35.0 percent or more	9	+/-8	60.0%	+/-38.0
Not computed	25	+/-18	(X)	(X)

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see Accuracy of the Data). The effect of nonsampling error is not represented in these tables.

The median gross rent excludes no cash renters.

In prior years, the universe included all owner-occupied units with a mortgage. It is now restricted to include only those units where SMOCAPI is computed, that is, SMOC and household income are valid values.

In prior years, the universe included all owner-occupied units without a mortgage. It is now restricted to include only those units where SMOCAPI is computed, that is, SMOC and household income are valid values.

In prior years, the universe included all renter-occupied units. It is now restricted to include only those units where GRAPI is computed, that is, gross rent and household Income are valid values.

The 2007, 2008, 2009, 2010, 2011, and 2012 plumbing data for Puerto Rico will not be shown. Research indicates that the questions on plumbing facilities that were introduced in 2008 in the stateside American Community Survey and the 2008 Puerto Rico Community Survey may not have been appropriate for Puerto Rico.

Median calculations for base table sourcing VAL, MHC, SMOC, and TAX should exclude zero values.

Telephone service data are not available for certain geographic areas due to problems with data collection. See Errata Note #93 for details.

While the 2008-2012 American Community Survey (ACS) data generally reflect the December 2009 Office of Management and Budget (OMB) definitions of metropolitan and micropolitan statistical areas; in certain instances the names, codes, and boundaries of the principal cities shown in ACS tables may differ from the OMB definitions due to differences in the effective dates of the geographic entities.

Estimates of urban and rural population, housing units, and characteristics reflect boundaries of urban areas defined based on Census 2000 data. Boundaries for urban areas have not been updated since Census 2000. As a result, data for urban and rural areas from the ACS do not necessarily reflect the results of ongoing urbanization.

Source: U.S. Census Bureau, 2008-2012 American Community Survey

Explanation of Symbols:

1. An '**' entry in the margin of error column indicates that either no sample observations or too few sample observations were available to compute a standard error and thus the margin of error. A statistical test is not appropriate.
2. An '-' entry in the estimate column indicates that either no sample observations or too few sample observations were available to compute an estimate, or a ratio of medians cannot be calculated because one or both of the median estimates falls in the lowest interval or upper interval of an open-ended distribution.
3. An '-' following a median estimate means the median falls in the lowest interval of an open-ended distribution.
4. An '+' following a median estimate means the median falls in the upper interval of an open-ended distribution.
5. An '***' entry in the margin of error column indicates that the median falls in the lowest interval or upper interval of an open-ended distribution. A statistical test is not appropriate.
6. An '*****' entry in the margin of error column indicates that the estimate is controlled. A statistical test for sampling variability is not appropriate.
7. An 'N' entry in the estimate and margin of error columns indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.
8. An '(X)' means that the estimate is not applicable or not available.

H Long Island Municipal Buildings - Detailed Energy Notes taken by Kate Unkel, Oct 2014 (Revised May 2015)

Bldgs/Spaces	Energy Comments
Bldg/Spaces	**Energy Comments**
Town Hall	No insulation; 2 fuel tanks fuel/yr.; garages decrepit
Community Center	New design more energy efficient, same footprint; fundraising $150k private donor; $500k community donations
School	Apparent discrepancy in last year's heating costs. Roof scheduled to be replaced in the next five years which could potentially accommodate solar panels

Town Bldgs, Parcel #, Address Town Hall, #503, 77 Wharf * Community Center, #503, 77 Wharf * Fire Barn, #514, 488 Island Ave * Generator, #512, 470 Island Ave * Marine Bldg, #530, 77 Wharf * Library learning center, #355, 33-35 Fern/7 Gorham Ave * VFW, #205, Island Ave * Public Works, #649, 158 Leavitt St	* Marine Bldg - woodstove, leased, private
Residential (Sean Rich) for energy uses monitor heater and wood stove (data in next column re. Rich) monitor 200 gallons/yr and woodstove 2-3 cords/yr = $1350/yr. Avg electric $80/mo Paula Johnson heats with oil	

Town of Long Island Code of Ordinances - Table of Contents (Revised May 10, 2014)

TOWN OF LONG ISLAND CODE OF ORDINANCES

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J Town of Long Island Code of Ordinances, Chapter 16, Articles I-V, Property Assessed Clean Energy (PACE) Ordinance

Chapter 16
Property Assessed Clean Energy (PACE) Ordinance
(Adopted May 14, 2011)

ARTICLE 1 – PURPOSE AND ENABLING LEGISLATION

Sec. 16-1 Purpose
By and through this Chapter, the Town of Long Island declares as its public purpose the establishment of a municipal program to enable its citizens to participate in a Property Assessed Clean Energy ("PACE") program so that owners of qualifying property can access financing for energy saving improvements to their properties located in the Town. The Town declares its purpose and the provisions of this Ordinance to be in conformity with federal and State laws.

Sec. 16-2 Enabling Legislation
The Town enacts this Ordinance pursuant to Public Law 2009, Chapter 591 of the 124th Maine State Legislature—"An Act To Increase the Affordability of Clean Energy for Homeowners and Businesses," also known as "the Property Assessed Clean Energy Act" or "the PACE Act" (codified at 35-A M.R.S.A. § 10151, *et seq*.).

ARTICLE II – TITLE AND DEFINITIONS

Sec. 16-3 Title
This Ordinance shall be known and may be cited as "the Town of Long Island Property Assessed Clean Energy (PACE) Ordinance" (the "Ordinance")."

Sec. 16-4 Definitions
Except as specifically defined below, words and phrases used in this Ordinance shall have their customary meanings; as used in this Ordinance, the following words and phrases shall have the meanings indicated:

1. **Energy saving improvement.** "Energy saving improvement" means an improvement to qualifying property that is new and permanently affixed to qualifying property and that:

   A. Will result in increased energy efficiency and substantially reduced energy use and:

      (1) Meets or exceeds applicable United States Environmental Protection Agency and United States Department of Energy – Energy Star program or similar energy efficiency standards established or approved by the Trust; or

      (2) Involves air sealing, insulating, and other energy efficiency improvements of residential, commercial or industrial property in a manner approved by the Trust; or

   B. Involves a renewable energy installation or an electric thermal storage system that meets or exceeds standards established or approved by the Trust.

2. **Municipality.** "Municipality" shall mean the Town of Long Island.

3. **PACE agreement.** "PACE agreement" means an agreement between the owner of qualifying property and the Trust that authorizes the creation of a PACE mortgage on qualifying property and that is approved in writing by all owners of the qualifying property at the time of agreement, other than mortgage holders.

4. **PACE assessment.** "PACE assessment" means an assessment made against qualifying property to repay a PACE loan.

5. **PACE district.** "PACE district" means the area within which the Municipality establishes a PACE program hereunder, which is all that area within the Municipality's boundaries.

6. **PACE loan.** "PACE" loan" means a loan, secured by a PACE mortgage, made to the owner(s) of a qualifying property pursuant to a PACE program to fund energy saving improvements.

7. **PACE mortgage.** "PACE mortgage" means a mortgage securing a loan made pursuant to a PACE program to fund energy saving improvements on qualifying property.

8. **PACE program.** "PACE program" means a program established under State statute by the Trust or a municipality under which property owners can finance energy savings improvements on qualifying property.

9. **Qualifying property.** "Qualifying property" means real property located in the PACE district of the Municipality.

10. **Renewable energy installation.** "Renewable energy installation" means a fixture, product, system, device or interacting group of devices installed behind the meter at a qualifying property, or on contiguous property under common ownership, that produces energy or heat from renewable sources, including, but not limited to, photovoltaic systems, solar thermal systems, biomass systems, landfill gas to energy systems, geothermal systems, wind systems, wood pellet systems and any other systems eligible for funding under federal Qualified Energy Conservation Bonds or federal Clean Renewable Energy Bonds.

11. **Trust.** "Trust" means the Efficiency Maine Trust established in 35-A M.R.S.A. § 10103 and/or its agent(s), if any.

ARTICLE III – PACE PROGRAM

1. **Establishment; funding.** The Municipality hereby establishes a PACE program allowing owners of qualifying property located in the PACE district who so choose to access financing for energy saving improvements to their property through PACE loans administered by the Trust or its agent. PACE loan funds are available from the Trust in municipalities that 1) adopt a PACE Ordinance, 2) adopt and implement a local public outreach and education plan, 3) enter into a PACE administration contract with the Trust to establish

the terms and conditions of the Trust's administration of the municipality's PACE program, and 4) agree to assist and cooperate with the Trust in its administration of the municipality's PACE program.

2. **Amendment to PACE program.** In addition, the Municipality may from time to time amend this Ordinance to use any other funding sources made available to it or appropriated by it for the express purpose of its PACE program, and the Municipality shall be responsible for administration of loans made from those other funding sources.

ARTICLE IV – CONFORMITY WITH THE REQUIREMENTS OF THE TRUST

1. **Standards adopted; Rules promulgated; model documents.** If the Trust adopts standards, promulgates rules, or establishes model documents subsequent to the Municipality's adoption of this Ordinance and those standards, rules or model documents substantially conflict with this Ordinance, the Municipality shall take necessary steps to conform this Ordinance and its PACE program to those standards, rules, or model documents.

ARTICLE V – PROGRAM ADMINISTRATION; MUNICIPAL LIABILITY

1. **Program Administration.**

   A. PACE Administration Contract. Pursuant to 35-A M.R.S.A. § 10154(2)(A)(2) and (B), the Municipality will enter into a PACE administration contract with the Trust to administer the functions of the PACE program for the Municipality. The PACE administration contract with the Trust will establish the administration of the PACE program including, without limitation, that:

      i. the Trust will enter into PACE agreements with owners of qualifying property in the Municipality's PACE district;

      ii. the Trust, or its agent, will create and record a Notice of the PACE agreement in the appropriate County Registry of Deeds to create a PACE mortgage;

      iii. the Trust, or its agent, will disburse the PACE loan to the property owner;

      iv. the Trust, or its agent, will send PACE assessment statements with payment deadlines to the property owner;

      v. the Trust, or its agent, will be responsible for collection of the PACE assessments;

      vi. the Trust, or its agent, will record any lien, if needed, due to nonpayment of the assessment;

vii. the Trust or its agent on behalf of the Municipality, promptly shall record the discharges of PACE mortgages upon full payment of the PACE loan.

B. Adoption of Education and Outreach Program. In conjunction with adopting this Ordinance, the Municipality shall adopt and implement an education and outreach program so that citizens of the Municipality are made aware of home energy saving opportunities, including the opportunity to finance energy saving improvements with a PACE loan.

C. Assistance and Cooperation. The Municipality will assist and cooperate with the Trust in its administration of the Municipality's PACE program.

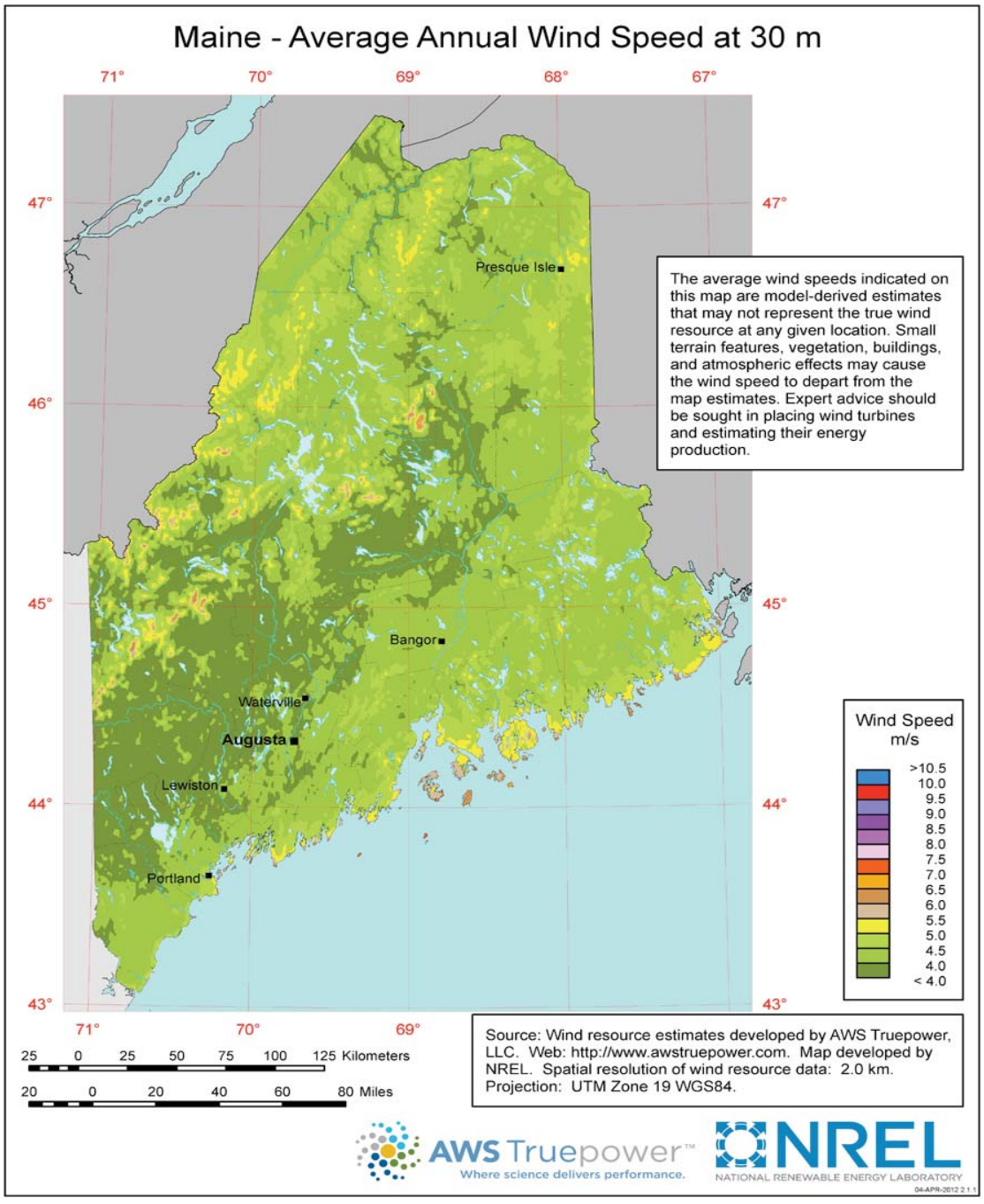
D. Assessments Not a Tax. PACE assessments do not constitute a tax but may be assessed and collected by the Trust in any manner determined by the Trust and consistent with applicable law.

2. Liability of Municipal Officials; Liability of Municipality.

A. Notwithstanding any other provision of law to the contrary, municipal officers and municipal officials, including, without limitation, tax assessors and tax collectors, are not personally liable to the Trust or to any other person for claims, of whatever kind or nature, under or related to a PACE program, including, without limitation, claims for or related to uncollected PACE assessments.

B. Other than the fulfillment of its obligations specified in a PACE administration contract with the Trust entered into under Article VI, § 1(A) above, a municipality has no liability to a property owner for or related to energy savings improvements financed under a PACE program.

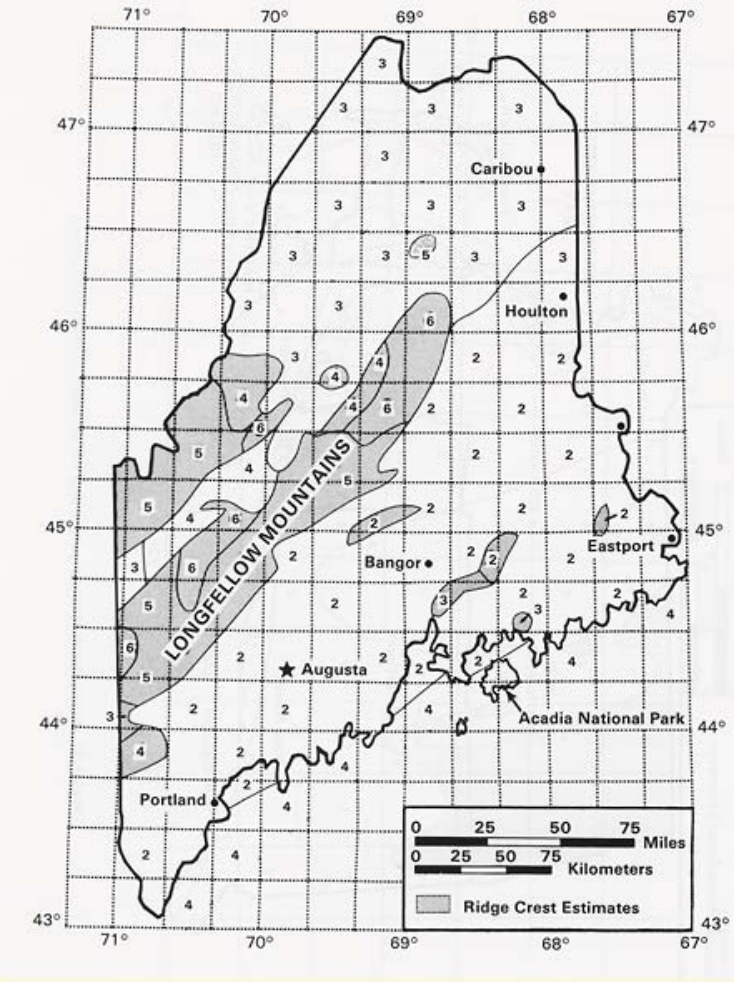
K Maine - NREL Average Annual Wind Speed at 30 m



L Maine - NREL Annual Average Wind Speed

http://rredc.nrel.gov

Wind Energy Resource Atlas of the United States, DL Elliott, CG Holladay, WR Barchet, HP Foote, WF Sandusky, October 1986, prepared for the US Department of Energy, Solar Technical Information Program and Solar Energy Research Institute, publishers



3-22 Maine annual average wind power

The Northeast Region

The Northeast region consists of Connecticut, Massachusetts, Rhode Island, Maine, New Hampshire, Vermont, New Jersey, New York, and Pennsylvania. The region's total population in

1980 of 49,136,000 represents approximately one-fourth of the nation's population. A large percentage of the people in the Northeast live in the corridor between Boston and Philadelphia, while large areas of northern Maine and upstate New York are quite sparsely populated. The major cities, rivers, lakes, and mountain ranges are shown in Map 3-20.

The topography varies dramatically throughout the Northeast. The Appalachian Mountains extend in a bank from northern Maine beyond the southern border of Pennsylvania. To the east of the mountains lie piedmont and coastal plain regions. West of the mountains the land becomes flatter as one approaches the Great Lakes. A large portion of the land area of the Northeast is composed of either hills and mountains or open hills and mountains, while large areas of Massachusetts, Rhode Island, Maine, and New York are plains containing hills. The only area of tablelands in the Northeast extends in an arc from the Hudson River valley, across central New York, and into northwestern Pennsylvania. Central and southern New Jersey contain the only true plains in the region.

Areas of class 3 or higher wind energy potential occur throughout much of the Northeast region. The primary areas of good wind energy resource are the Atlantic coast, the Great Lakes, and exposed hilltops, ridge crests, and mountain summits from Pennsylvania to Maine. Areas of highest wind energy potential (class 5 and 6) are the outer coastal areas such as Cape Cod and Nantucket Island, offshore areas of Lake Ontario and Lake Erie, and the higher mountain summits of the Appalachians. Winter is the season of maximum wind power throughout the Northeast region. During this season, all except the most sheltered areas have class 3 or better wind resource, and exposed coastal areas and mountain summits can expect class 6 or 7 wind resource. In summer, the season of minimum wind power, class 3 wind resource can be found only on the outer coastal areas and highest mountain summits.

Major areas of wind resource in the Northeast region are described below. Maps of annual average wind power are presented in Maps 3-21 through 3-26 for Connecticut, Massachusetts and Rhode Island (displayed on one map), Maine, New Hampshire and Vermont (displayed on one map), New Jersey, New York, and Pennsylvania.

Atlantic Coastal Areas

The annual average wind power for exposed Atlantic coastal and offshore islands of the Northeast is primarily class 4, 5, and 6. Class 4 is found immediately along the coast, while class 6 exists along the outer capes and islands such as Cape Cod and Nantucket Island. Semi-enclosed bodies of water, such as Long Island Sound and Delaware Bay, have a lower wind resource (class 3).

When onshore flow occurs, the abrupt change in surface roughness inland from the coastline, because of vegetation and topography, rapidly attenuates the wind resource landward. The strongest onshore flow on the synoptic scale occurs most frequently in the winter and early spring and is associated with strong pressure gradients occurring with coastal storms.

Wind measurements up to 46 m (150 ft) above ground have been taken at four DOE-installed tower sites along the northeastern Atlantic coast—Nantucket Island and Provincetown, Massachusetts; Montauk Point, New York; and Block Island, Rhode Island. Long-term data (5 yr) from both Block Island and Montauk Point indicated class 4 annual average wind power at 50 m (164 ft) for those areas. Limited data (2 yr) from Nantucket Island and Provincetown indicated that these outer areas could have class 6 or better annual average wind power at 50 m (164 ft). At 10 m (33 ft), the annual average wind power varied considerably among these four sites and was only class 2 at Block Island and Provincetown. These data provide excellent examples of how local roughness features such as vegetation and buildings can reduce the wind power at levels near the ground and how near surface (10-m or 33 ft) data may not provide a realistic indication of the wind power at 50 m (164 ft).

Hills and Mountains of Vermont, New Hampshire, Maine, Massachusetts, and Connecticut

An extensive area, including most of Vermont and New Hampshire, as well as much of Maine, Massachusetts, and Connecticut, has annual average wind power of class 3 or higher on exposed locations. Highest powers (class 5 and 6) occur on the best-exposed mountain and ridge tops in Vermont's Green Mountains, New Hampshire's White Mountains, and Maine's Longfellow Mountains. The remainder of the hilltops and mountain tops in this area that are outside of these major ranges have class 3 or 4 wind power. At the highest elevations this wind power increases to class 6 and 7 in the winter. Average wind speeds may vary significantly from one ridge crest to another and are primarily influenced by the height and slope of the ridge, orientation to the prevailing winds, and the proximity of other mountains and ridges. For example, the White Mountains are indicated to have class 6 wind power, but Mount Washington, at 1,917 m (6,288 ft) elevation, is known to have considerably greater wind power as a result of terrain-induced acceleration as the air passes over the mountain.

M Summary of University of Maine's Final *Wind Data Report,* Peaks Island

All available data concerning the Peak's Island wind study can be found at http://www.greenerpeaks.org/windpower/reports.html or by contacting Sam Saltonstall at ssalty88@gmail.com. The study is organized into quarterly reports. The last report, below, gives the final summary of results.

NOT FOR DISTRIBUTION

Summary of University of Maine's final *Wind Data Report* on the wind testing done at Trott-Littlejohn Park on Peaks Island from August 23, 2010 until August 27, 2011:

- The report summarizes the fourth quarter testing results. (Separate reports were mailed for the preceding three quarters.) They include data on wind speed, percentage of time spent at each wind speed, average velocities for the time of day or night, prevailing wind direction, turbulence intensity, and wind shear.
- Wind shear is "a measure of the rate of increase in wind speed as you increase the elevation. For wind developers, wind shear is important as it helps to determine the appropriate wind turbine hub height. The higher the value of shear, the faster the wind speed increases".
- The report includes wind shear coefficient calculations for each month and estimated power density and power production for a Northern Power Northwind 100 wind turbine generator, of typical size for community scale generation.
- It states that the test results show the Peaks test site is not economically viable for a 37m tower because the average wind speed over the testing period at 30m was 3.73 meters per second (8.34 mph), below the viable standard for commercial wind turbine operation of around 4.5 m/s (just over 10 mph).
- It goes on to say that "new turbine designs that have lower cut in speeds are being developed and may be viable for this site."
- It explains that assuming an electricity cost of 18 cents per KWh, wind generation at the site could produce $19,703.13 in electricity savings, but then states that this is "not sufficient to justify the purchase of a wind turbine".

PEAT's wind group shared the University of Maine's final report summarized above with Dr. Mick Womersly of Unity College, who early on had been helpful to our effort, and with islander, Lawrence Mott, who works in the wind industry and is very familiar with the kind of testing that was done here.

Dr. Womersly said that the test site has an unusually high wind shear coefficient, and suggested that projected velocities at higher elevations may have been estimated on the conservative side by UM. He reminded us that net metering (if, say, the transfer station were to use the electricity generated to turn their meter backwards) fetches an attractive credit for the electricity generated, and felt that grants and low interest bonds might make the project more financially feasible.

Lawrence was less optimistic. He plugged numbers into a spreadsheet which included cost of capital, assumptions about a generous grant, cost of the turbine, its installation and connection to the grid, and assumed a generous grant of $250,000 was in hand. Without factoring in the extra costs of doing the project on an island, the cost of the wind generated came out to 21 cents per killowatt hour. The project would be "under water for the first 11 years of its 25 year lifetime". Since we currently pay around 16 cents per kilowatt hour for our standard offer electricity, Lawrence feels that tackling a wind project on Peaks doesn't make good economic sense at this time.

N Solar Pathfinder Data and Analytical Findings

For brevity the Team has excluded the Solar Pathfinder report page which indicates these readings are taken from single points, as opposed to all four corners of a theoretical solar array. Please note: This is the case with all readings. Data represents theoretical centers only.

(a) Data Map

(b) Report 1a

Site Report

Report Name	Long Island
Report Date	10/25/2014 9:17:21 PM
Declination	-15d 39m
Location	Lat/Long specified
Lat/Long	43.63 / -70.05
Weather Station	Portland Intl Jetport, ME, Elevation: 46 Feet, (43.650/-70.300)
Site Distance	13 Miles
Report Type	PV
Array Type	Fixed Angle
Tilt Angle	43.63 deg
Ideal Tilt Angle	43.63 deg
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Electric Cost	0.17 ($/kWh)
Panel Make	Canadian Solar
Panel Model	CS6P-250P
Panel Count	20
DC Rate (per panel)	250.0 Watts
Unshaded Percent	97.6 %
STC System Size	5.00 kW
DC System Size	4.88 kW
AC System Size	3.90 kW
Inverter Make	Enphase Energy
Inverter Model	M250-60-2LL-S2X (-ZC) (-NA) (240V)
Inverter Count	20
Derate Method	System Setting
DC to AC Derate Factor	0.800
Layout Configuration	Single Picture
Layout Point Count	1

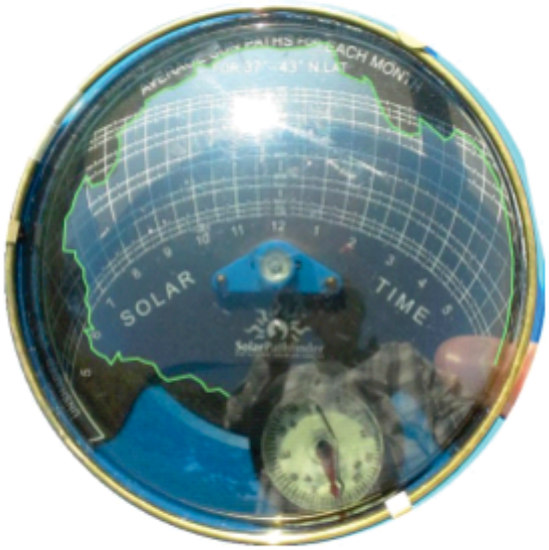
Notes: This report is one of two making up a preliminary assessment of the area with the concrete slab and small meadow just above the far end of the town parking.The assesment is sized for 10kw, or 40 panels at 250w each. This one specifically is a measurement of the meadow area.

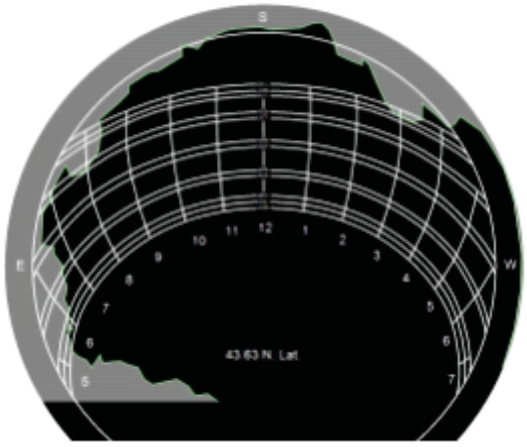
Summary Report

Solar Obstruction Data						
Month	**Unshaded % of Ideal Site Azimuth=180 Tilt=43.63**	**Actual Shaded Solar Radiation Azimuth=180.0 Tilt=43.63 kWh/m²**	**Actual Shaded AC Energy (kWh) Azimuth=180.00 Tilt=43.63**	**Actual Unshaded AC Energy (kWh) Azimuth=180.0 Tilt=43.63**	**Ideal Unshaded AC Energy (kWh) Azimuth=180.0 Tilt=43.63**	**PV Solar Cost Savings 0.17 ($/kWh)**
January	95.46 %	3.34	444.34	468.00	468.00	$75.54
February	97.65 %	4.38	514.81	530.00	530.00	$87.52
March	100.00 %	5.07	634.00	634.00	634.00	$107.78
April	97.99 %	4.95	581.58	589.00	589.00	$98.87
May	98.30 %	5.20	607.69	610.00	610.00	$103.31
June	99.33 %	4.98	545.63	546.00	546.00	$92.76
July	98.91 %	5.68	635.27	636.00	636.00	$108.00
August	98.40 %	5.47	623.41	628.00	628.00	$105.98
September	98.89 %	5.25	596.05	602.00	602.00	$101.33
October	100.00 %	4.20	510.00	513.00	513.00	$86.70
November	96.23 %	2.86	347.83	370.00	370.00	$59.13
December	93.63 %	2.75	360.30	392.00	392.00	$61.25
Totals	**97.90%**	**54.12**	**6,400.91**	**6,518.00**	**6,518.00**	**$1,088.15**
	Unweighted	**Effect: 97.57%**				
	Yearly Avg	**Sun Hrs: 4.51**				

Notes: This report is one of two making up a preliminary assessment of the area with the concrete slab and small meadow just above the far end of the town parking.The assesment is sized for 10kw, or 40 panels at 250w each. This one specifically is a measurement of the meadow area.

Notes: Far corner parking/concrete slab area, meadow side





(c) Report 1b

Site Report

Report Name	Report for Area 1b
Report Date	10/27/2014 10:32:14 PM
Declination	-15d 39m
Location	Lat/Long specified
Lat/Long	43.63 / -70.05
Weather Station	Portland Intl Jetport, ME, Elevation: 46 Feet, (43.650/-70.300)
Site Distance	13 Miles
Report Type	PV
Array Type	Fixed Angle
Tilt Angle	43.63 deg
Ideal Tilt Angle	43.63 deg
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Electric Cost	0.17 ($/kWh)
Panel Make	Canadian Solar
Panel Model	CS6P-250P
Panel Count	20
DC Rate (per panel)	250.0 Watts
Unshaded Percent	98.3 %
STC System Size	5.00 kW
DC System Size	4.92 kW
AC System Size	3.93 kW
Inverter Make	Enphase Energy
Inverter Model	M250-60-2LL-S2X (-ZC) (-NA) (240V)
Inverter Count	20
Derate Method	System Setting
DC to AC Derate Factor	0.800
Layout Configuration	Single Picture
Layout Point Count	1

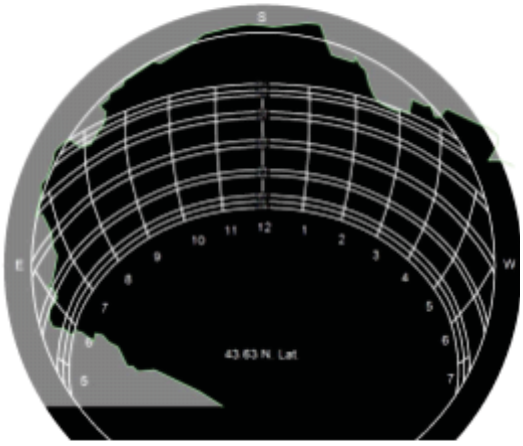
Notes: This is the second of two reports assessing the viability of an array across the concrete slab/meadow area above the long term town parking for 40 panels at 250w each. The reading in this report is taken from atop the concrete foundation in this area, which is further to the right when facing inland. Both of these theoretical arrays are oriented due south, which at this time seems like a viable option given the available space even though the parking below is slightly more southwest facing.

Summary Report

Solar Obstruction Data						
Month	**Unshaded % of Ideal Site Azimuth=180 Tilt=43.63**	**Actual Shaded Solar Radiation Azimuth=180.0 Tilt=43.63 kWh/m²**	**Actual Shaded AC Energy (kWh) Azimuth=180.00 Tilt=43.63**	**Actual Unshaded AC Energy (kWh) Azimuth=180.0 Tilt=43.63**	**Ideal Unshaded AC Energy (kWh) Azimuth=180.0 Tilt=43.63**	**PV Solar Cost Savings 0.17 ($/kWh)**
January	97.46 %	3.43	453.99	468.00	468.00	$77.18
February	100.00 %	4.52	530.00	530.00	530.00	$90.10
March	99.64 %	5.03	632.80	634.00	634.00	$107.58
April	99.20 %	5.01	586.82	589.00	589.00	$99.76
May	99.07 %	5.23	609.34	610.00	610.00	$103.59
June	98.39 %	4.95	545.11	546.00	546.00	$92.67
July	98.91 %	5.68	635.27	636.00	636.00	$108.00
August	99.32 %	5.51	626.77	628.00	628.00	$106.55
September	98.67 %	5.23	594.90	602.00	602.00	$101.13
October	100.00 %	4.20	510.00	513.00	513.00	$86.70
November	98.27 %	3.00	361.92	370.00	370.00	$61.53
December	93.39 %	2.74	357.83	392.00	392.00	$60.83
Totals	**98.53%**	**54.54**	**6,444.74**	**6,518.00**	**6,518.00**	**$1,095.60**
	Unweighted	**Effect: 98.31%**				
	Yearly Avg	**Sun Hrs: 4.54**				

Notes: This is the second of two reports assessing the viability of an array across the concrete slab/meadow area above the long term town parking for 40 panels at 250w each. The reading in this report is taken from atop the concrete foundation in this area, which is further to the right when facing inland. Both of these theoretical arrays are oriented due south, which at this time seems like a viable option given the available space even though the parking below is slightly more southwest facing.

Notes: taken from the concrete foundation,Taken together, sites 1 and 2 give an approximation from either end of a potential array over this entire area.



(d) Report 2a

Site Report

Report Name	SPF Report 2a (Car Lot)
Report Date	10/28/2014 9:06:00 AM
Declination	-15d 39m
Location	Lat/Long specified
Lat/Long	43.63 / -70.05
Weather Station	Portland Intl Jetport, ME, Elevation: 46 Feet, (43.650/-70.300)
Site Distance	13 Miles
Report Type	PV
Array Type	Fixed Angle
Tilt Angle	43.63 deg
Ideal Tilt Angle	43.63 deg
Azimuth	135.00 deg
Ideal Azimuth	180.00 deg
Electric Cost	0.17 ($/kWh)
Panel Make	Canadian Solar
Panel Model	CS6P-250P
Panel Count	30
DC Rate (per panel)	250.0 Watts
Unshaded Percent	86.9 %
STC System Size	7.50 kW
DC System Size	6.52 kW
AC System Size	5.21 kW
Inverter Make	Enphase Energy
Inverter Model	M250-60-2LL-S2X (-ZC) (-NA) (240V)
Inverter Count	30
Derate Method	System Setting
DC to AC Derate Factor	0.800
Layout Configuration	Single Picture
Layout Point Count	1

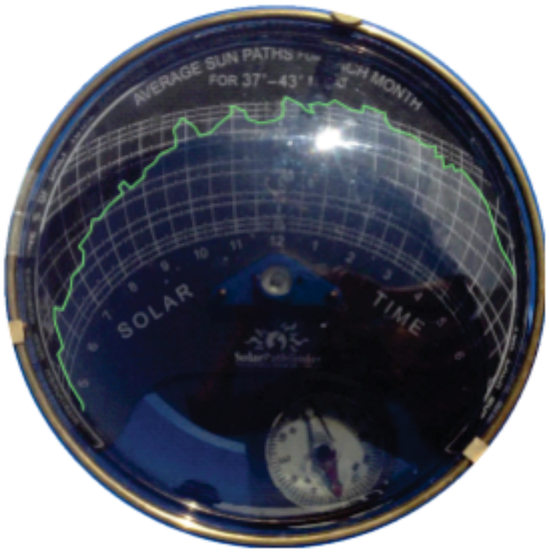
Notes: This is the spot where there are several rows of parking area inland of the shoreline parking. It was the site that Nate initially mentioned, potentially to be used for a solar carport. The theoretical array is oriented at 135 degrees (directly southeast), instead of due south. Though this is not ideal, it seems that it would be exceedingly difficult and cause further problems both to either re-orient the parking spaces or to set the array at due south in spite of the parking.

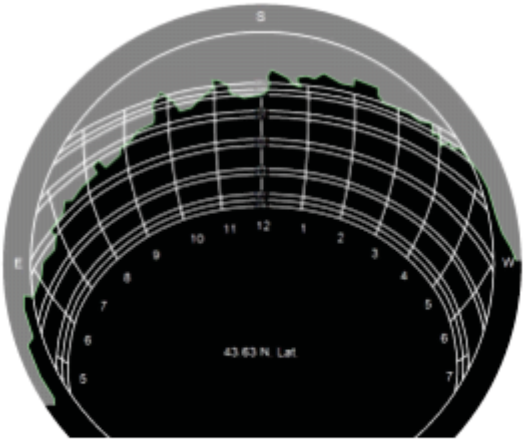
Summary Report

Solar Obstruction Data						
Month	**Unshaded % of Ideal Site Azimuth=180 Tilt=43.63**	**Actual Shaded Solar Radiation Azimuth=135.0 Tilt=43.63 kWh/m²**	**Actual Shaded AC Energy (kWh) Azimuth=135.00 Tilt=43.63**	**Actual Unshaded AC Energy (kWh) Azimuth=135.0 Tilt=43.63**	**Ideal Unshaded AC Energy (kWh) Azimuth=180.0 Tilt=43.63**	**PV Solar Cost Savings 0.17 ($/kWh)**
January	50.28 %	1.42	268.27	567.00	701.00	$45.61
February	80.47 %	3.10	532.40	682.00	794.00	$90.51
March	99.03 %	4.58	859.80	876.00	951.00	$146.17
April	100.00 %	4.84	842.00	842.00	882.00	$143.14
May	100.00 %	5.11	886.00	886.00	913.00	$150.62
June	100.00 %	4.95	811.00	811.00	819.00	$137.87
July	100.00 %	5.68	950.00	950.00	953.00	$161.50
August	100.00 %	5.25	885.00	885.00	944.00	$150.45
September	96.18 %	4.74	797.84	846.00	904.00	$135.63
October	79.43 %	2.80	496.92	684.00	770.00	$84.48
November	57.52 %	1.34	231.53	448.00	554.00	$39.36
December	33.90 %	0.81	151.27	492.00	590.00	$25.72
Totals	**83.07%**	**44.62**	**7,712.03**	**8,969.00**	**9,775.00**	**$1,311.04**
	Unweighted	**Effect: 80.44%**				
	Yearly Avg	**Sun Hrs: 3.72**				

Notes: This is the spot where there are several rows of parking area inland of the shoreline parking. It was the site that Nate initially mentioned, potentially to be used for a solar carport. The theoretical array is oriented at 135 degrees (directly southeast), instead of due south. Though this is not ideal, it seems that it would be exceedingly difficult and cause further problems both to either re-orient the parking spaces or to set the array at due south in spite of the parking.

Notes: Taken from on top of a golf cart in the center of the parking area





(e) Report 2b

Site Report

Report Name	SPF Report 2b (car lot)
Report Date	10/28/2014 7:28:26 PM
Declination	-15d 39m
Location	Lat/Long specified
Lat/Long	43.63 / -70.05
Weather Station	Portland Intl Jetport, ME, Elevation: 46 Feet, (43.650/-70.300)
Site Distance	13 Miles
Report Type	PV
Array Type	Fixed Angle
Tilt Angle	43.63 deg
Ideal Tilt Angle	43.63 deg
Azimuth	135.00 deg
Ideal Azimuth	180.00 deg
Electric Cost	0.17 ($/kWh)
Panel Make	Canadian Solar
Panel Model	CS6P-250P
Panel Count	30
DC Rate (per panel)	250.0 Watts
Unshaded Percent	91.5 %
STC System Size	7.50 kW
DC System Size	6.86 kW
AC System Size	5.49 kW
Inverter Make	Enphase Energy
Inverter Model	M250-60-2LL-S2X (-ZC) (-NA) (240V)
Inverter Count	30
Derate Method	System Setting
DC to AC Derate Factor	0.800
Layout Configuration	Single Picture
Layout Point Count	1

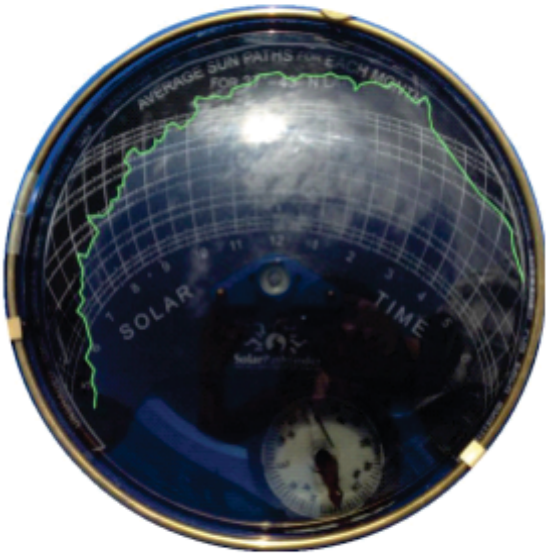
Notes: The 2nd photo taken from the car lot, together making a theoretical 15kw southeast facing carport (or several) array over the entire area. The reading is taken closer to the water, and is also from a slightly lower position, which was not ideal, do to complications in balancing the array. However, it shouldn't be a large enough distance to make any difference in such a prelimary, broad estimate.

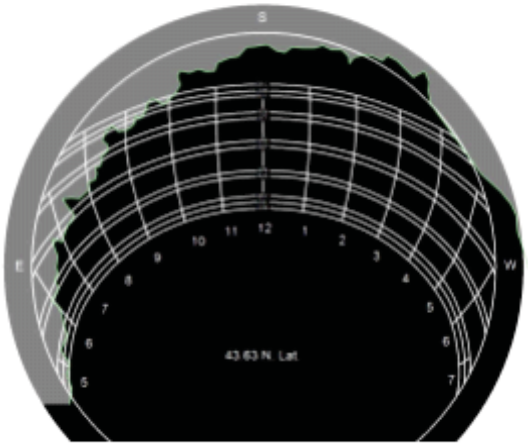
Summary Report

Solar Obstruction Data						
Month	**Unshaded % of Ideal Site Azimuth=180 Tilt=43.63**	**Actual Shaded Solar Radiation Azimuth=135.0 Tilt=43.63 kWh/m²**	**Actual Shaded AC Energy (kWh) Azimuth=135.00 Tilt=43.63**	**Actual Unshaded AC Energy (kWh) Azimuth=135.0 Tilt=43.63**	**Ideal Unshaded AC Energy (kWh) Azimuth=180.0 Tilt=43.63**	**PV Solar Cost Savings 0.17 ($/kWh)**
January	87.85 %	2.30	445.31	567.00	701.00	$75.70
February	94.18 %	3.44	592.78	682.00	794.00	$100.77
March	97.69 %	4.36	818.12	876.00	951.00	$139.08
April	98.82 %	4.69	818.08	842.00	882.00	$139.07
May	98.91 %	4.99	865.89	886.00	913.00	$147.20
June	99.92 %	4.94	809.84	811.00	819.00	$137.67
July	99.72 %	5.65	945.44	950.00	953.00	$160.72
August	99.55 %	5.15	870.95	885.00	944.00	$148.06
September	96.99 %	4.61	773.59	846.00	904.00	$131.51
October	92.91 %	3.09	552.12	684.00	770.00	$93.86
November	90.34 %	2.03	358.14	448.00	554.00	$60.88
December	82.72 %	1.75	335.36	492.00	590.00	$57.01
Totals	**94.97%**	**47.00**	**8,185.62**	**8,969.00**	**9,775.00**	**$1,391.56**
	Unweighted	**Effect: 84.72%**				
	Yearly Avg	**Sun Hrs: 3.92**				

Notes: The 2nd photo taken from the car lot, together making a theoretical 15kw southeast facing carport (or several) array over the entire area. The reading is taken closer to the water, and is also from a slightly lower position, which was not ideal, do to complications in balancing the array. However, it shouldn't be a large enough distance to make any difference in such a prelimary, broad estimate.

Notes: slightly closer to the water than 2a, and from a lower position.





(f) Report Waterfront 1

Site Report

Report Name	SPF Report Waterfront Parking 1
Report Date	11/13/2014 10:11:31 PM
Declination	-15d 38m
Location	Lat/Long specified
Lat/Long	43.63 / -70.05
Weather Station	Portland Intl Jetport, ME, Elevation: 46 Feet, (43.650/-70.300)
Site Distance	13 Miles
Report Type	PV
Array Type	Fixed Angle
Tilt Angle	43.63 deg
Ideal Tilt Angle	43.63 deg
Azimuth	135.00 deg
Ideal Azimuth	180.00 deg
Electric Cost	0.17 ($/kWh)
Panel Make	Canadian Solar
Panel Model	CS6P-250P
Panel Count	15
DC Rate (per panel)	250.0 Watts
Unshaded Percent	98.9 %
STC System Size	3.75 kW
DC System Size	3.71 kW
AC System Size	2.97 kW
Inverter Make	Enphase Energy
Inverter Model	M250-60-2LL-S2X (-ZC) (-NA) (240V)
Inverter Count	15
Derate Method	System Setting
DC to AC Derate Factor	0.800
Layout Configuration	Single Picture
Layout Point Count	1

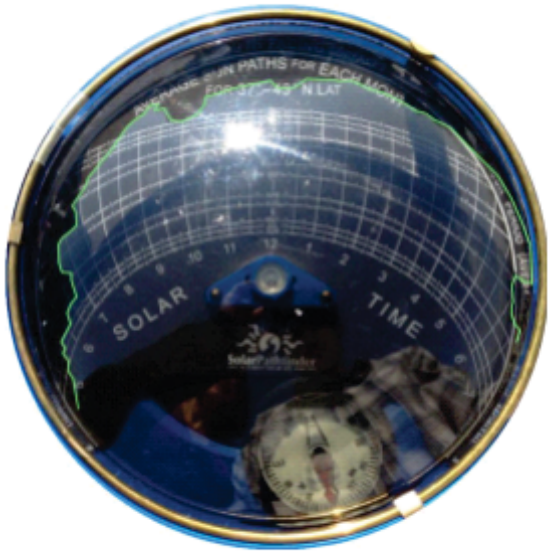
Notes: This is the first of the waterfront parking readings, taken from the furthest northeast point along this strip.

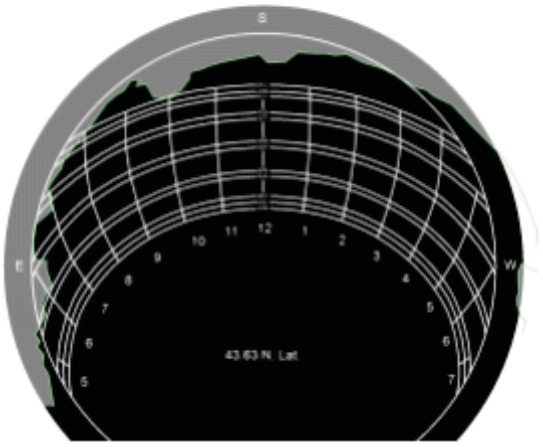
Summary Report

Solar Obstruction Data						
Month	**Unshaded % of Ideal Site Azimuth=180 Tilt=43.63**	**Actual Shaded Solar Radiation Azimuth=135.0 Tilt=43.63 kWh/m²**	**Actual Shaded AC Energy (kWh) Azimuth=135.00 Tilt=43.63**	**Actual Unshaded AC Energy (kWh) Azimuth=135.0 Tilt=43.63**	**Ideal Unshaded AC Energy (kWh) Azimuth=180.0 Tilt=43.63**	**PV Solar Cost Savings 0.17 ($/kWh)**
January	99.74 %	2.89	281.80	283.00	350.00	$47.91
February	99.80 %	3.91	340.19	342.00	395.00	$57.83
March	100.00 %	4.67	438.00	438.00	475.00	$74.46
April	99.83 %	4.82	419.40	421.00	444.00	$71.30
May	100.00 %	5.11	443.00	443.00	458.00	$75.31
June	100.00 %	4.95	405.00	405.00	407.00	$68.85
July	100.00 %	5.68	475.00	475.00	477.00	$80.75
August	100.00 %	5.25	444.00	444.00	469.00	$75.48
September	98.95 %	4.92	413.18	421.00	453.00	$70.24
October	99.61 %	3.65	329.36	343.00	385.00	$55.99
November	100.00 %	2.53	224.00	225.00	277.00	$38.08
December	98.69 %	2.44	233.89	245.00	296.00	$39.76
Totals	**99.72%**	**50.82**	**4,446.81**	**4,485.00**	**4,886.00**	**$755.96**
	Unweighted	**Effect: 91.61%**				
	Yearly Avg	**Sun Hrs: 4.23**				

Notes: This is the first of the waterfront parking readings, taken from the furthest northeast point along this strip.

Notes: picture 3075





(g) Report Waterfront 2

Site Report

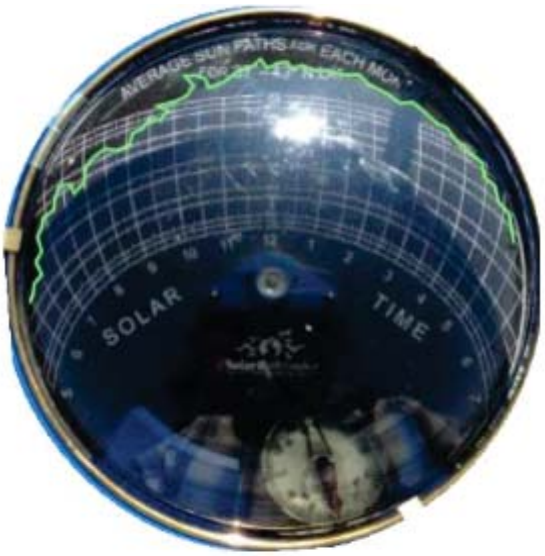
Report Name	SPF Report waterfront parking 2
Report Date	10/31/2014 10:44:20 AM
Declination	-15d 38m
Location	Lat/Long specified
Lat/Long	43.63 / -70.05
Weather Station	Portland Intl Jetport, ME, Elevation: 46 Feet, (43.650/-70.300)
Site Distance	13 Miles
Report Type	PV
Array Type	Fixed Angle
Tilt Angle	43.63 deg
Ideal Tilt Angle	43.63 deg
Azimuth	135.00 deg
Ideal Azimuth	180.00 deg
Electric Cost	0.17 ($/kWh)
Panel Make	Canadian Solar
Panel Model	CS6P-250P
Panel Count	15
DC Rate (per panel)	250.0 Watts
Unshaded Percent	99.0 %
STC System Size	3.75 kW
DC System Size	3.71 kW
AC System Size	2.97 kW
Inverter Make	Enphase Energy
Inverter Model	M250-60-2LL-S2X (-ZC) (-NA) (240V)
Inverter Count	15
Derate Method	System Setting
DC to AC Derate Factor	0.800
Layout Configuration	Single Picture
Layout Point Count	1

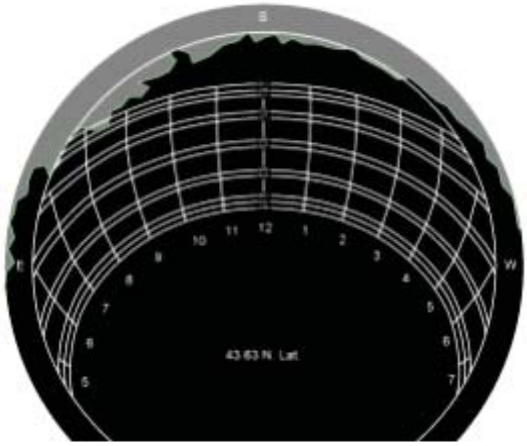
Notes: This is the 2nd of a series of readings taken from the line of parking along the waterfront, mostly from under the lampposts there.They begin from the furthest point northeast along this parking area, moving steadily southwest about every 30 feet per reading.

Summary Report

Solar Obstruction Data						
Month	**Unshaded % of Ideal Site Azimuth=180 Tilt=43.63**	**Actual Shaded Solar Radiation Azimuth=135.0 Tilt=43.63 kWh/m²**	**Actual Shaded AC Energy (kWh) Azimuth=135.00 Tilt=43.63**	**Actual Unshaded AC Energy (kWh) Azimuth=135.0 Tilt=43.63**	**Ideal Unshaded AC Energy (kWh) Azimuth=180.0 Tilt=43.63**	**PV Solar Cost Savings 0.17 ($/kWh)**
January	100.00 %	2.91	283.00	283.00	350.00	$48.11
February	100.00 %	3.92	341.00	342.00	395.00	$57.97
March	100.00 %	4.67	438.00	438.00	475.00	$74.46
April	100.00 %	4.84	421.00	421.00	444.00	$71.57
May	100.00 %	5.11	443.00	443.00	458.00	$75.31
June	100.00 %	4.95	405.00	405.00	407.00	$68.85
July	100.00 %	5.68	475.00	475.00	477.00	$80.75
August	100.00 %	5.25	444.00	444.00	469.00	$75.48
September	100.00 %	4.99	419.00	421.00	453.00	$71.23
October	100.00 %	3.67	331.00	343.00	385.00	$56.27
November	100.00 %	2.53	224.00	225.00	277.00	$38.08
December	93.56 %	2.31	221.67	245.00	296.00	$37.68
Totals	**99.46%**	**50.83**	**4,445.67**	**4,485.00**	**4,886.00**	**$755.76**
	Unweighted	**Effect: 91.63%**				
	Yearly Avg	**Sun Hrs: 4.24**				

Notes: This is the 2nd of a series of readings taken from the line of parking along the waterfront, mostly from under the lampposts there.They begin from the furthest point northeast along this parking area, moving steadily southwest about every 30 feet per reading.





(h) Report Waterfront 3

Site Report

Report Name	SPF Report Waterfront Parking 3
Report Date	11/3/2014 4:44:35 PM
Declination	-15d 38m
Location	Lat/Long specified
Lat/Long	43.63 / -70.05
Weather Station	Portland Intl Jetport, ME, Elevation: 46 Feet, (43.650/-70.300)
Site Distance	13 Miles
Report Type	PV
Array Type	Fixed Angle
Tilt Angle	43.63 deg
Ideal Tilt Angle	43.63 deg
Azimuth	135.00 deg
Ideal Azimuth	180.00 deg
Electric Cost	0.17 ($/kWh)
Panel Make	Canadian Solar
Panel Model	CS6P-250P
Panel Count	15
DC Rate (per panel)	250.0 Watts
Unshaded Percent	97.1 %
STC System Size	3.75 kW
DC System Size	3.64 kW
AC System Size	2.91 kW
Inverter Make	Enphase Energy
Inverter Model	M250-60-2LL-S2X (-ZC) (-NA) (240V)
Inverter Count	15
Derate Method	System Setting
DC to AC Derate Factor	0.800
Layout Configuration	Single Picture
Layout Point Count	1

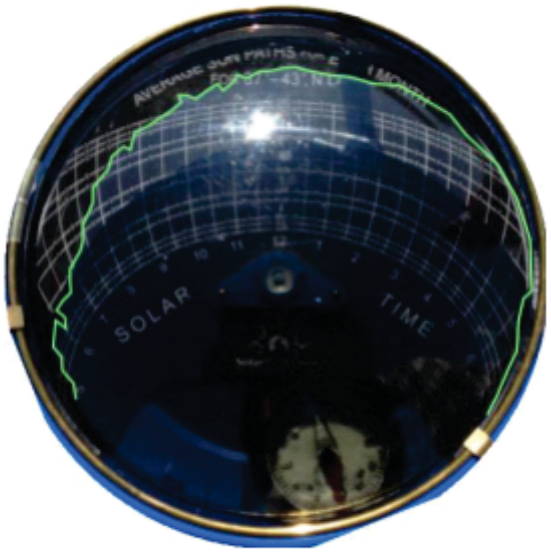
Notes: This is the 3rd of the readings taken along the waterfront town parking strip, moving from northeast to southwest. There is a larger space than usual between this reading and number 2, since there was previously another reading taken between them which is missing.

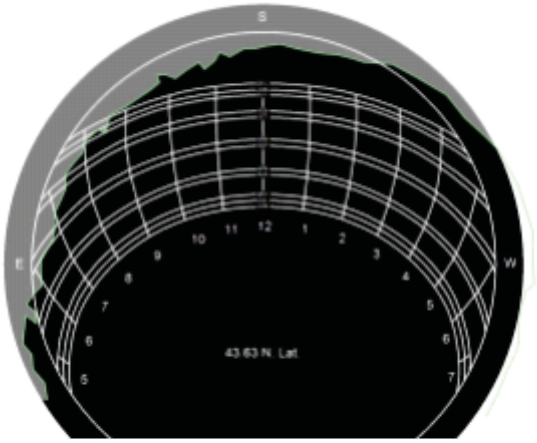
Summary Report

Solar Obstruction Data						
Month	**Unshaded % of Ideal Site Azimuth=180 Tilt=43.63**	**Actual Shaded Solar Radiation Azimuth=135.0 Tilt=43.63 kWh/m²**	**Actual Shaded AC Energy (kWh) Azimuth=135.00 Tilt=43.63**	**Actual Unshaded AC Energy (kWh) Azimuth=135.0 Tilt=43.63**	**Ideal Unshaded AC Energy (kWh) Azimuth=180.0 Tilt=43.63**	**PV Solar Cost Savings 0.17 ($/kWh)**
January	93.11 %	2.69	262.26	283.00	350.00	$44.58
February	97.97 %	3.83	332.86	342.00	395.00	$56.59
March	98.71 %	4.55	427.60	438.00	475.00	$72.69
April	100.00 %	4.84	421.00	421.00	444.00	$71.57
May	100.00 %	5.11	443.00	443.00	458.00	$75.31
June	100.00 %	4.95	405.00	405.00	407.00	$68.85
July	100.00 %	5.68	475.00	475.00	477.00	$80.75
August	100.00 %	5.25	444.00	444.00	469.00	$75.48
September	97.73 %	4.84	406.44	421.00	453.00	$69.09
October	96.47 %	3.51	316.20	343.00	385.00	$53.75
November	95.62 %	2.34	207.30	225.00	277.00	$35.24
December	91.64 %	2.26	217.11	245.00	296.00	$36.91
Totals	**97.60%**	**49.85**	**4,357.77**	**4,485.00**	**4,886.00**	**$740.82**
	Unweighted	**Effect: 89.87%**				
	Yearly Avg	**Sun Hrs: 4.15**				

Notes: This is the 3rd of the readings taken along the waterfront town parking strip, moving from northeast to southwest. There is a larger space than usual between this reading and number 2, since there was previously another reading taken between them which is missing.

Notes: image 3085 in my files.





(i) Report Waterfront 4

*this computer document is accidentally titled 5. This is a mistake. It was not possible to remedy due to unforeseen technical issues with the computer of origin.

Site Report

Report Name	SPF Report Waterfront Parking 5
Report Date	11/3/2014 4:58:06 PM
Declination	-15d 38m
Location	Lat/Long specified
Lat/Long	43.63 / -70.05
Weather Station	Portland Intl Jetport, ME, Elevation: 46 Feet, (43.650/-70.300)
Site Distance	13 Miles
Report Type	PV
Array Type	Fixed Angle
Tilt Angle	43.63 deg
Ideal Tilt Angle	43.63 deg
Azimuth	135.00 deg
Ideal Azimuth	180.00 deg
Electric Cost	0.17 ($/kWh)
Panel Make	Canadian Solar
Panel Model	CS6P-250P
Panel Count	15
DC Rate (per panel)	250.0 Watts
Unshaded Percent	99.3 %
STC System Size	3.75 kW
DC System Size	3.72 kW
AC System Size	2.98 kW
Inverter Make	Enphase Energy
Inverter Model	M250-60-2LL-S2X (-ZC) (-NA) (240V)
Inverter Count	15
Derate Method	System Setting
DC to AC Derate Factor	0.800
Layout Configuration	Single Picture
Layout Point Count	1

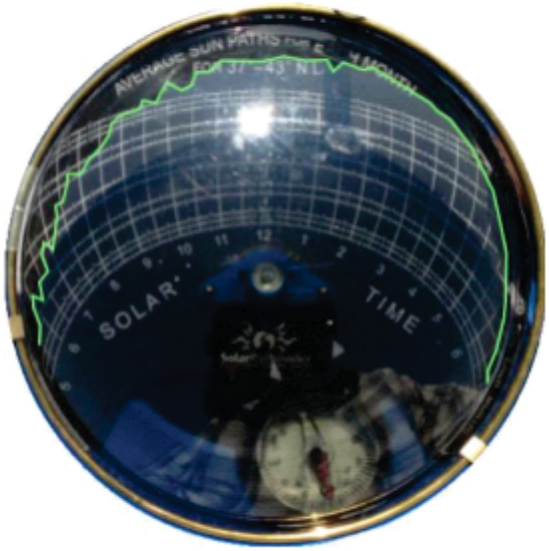
Notes: This is the 4th of the series of readings taken, moving northeast to southwest.

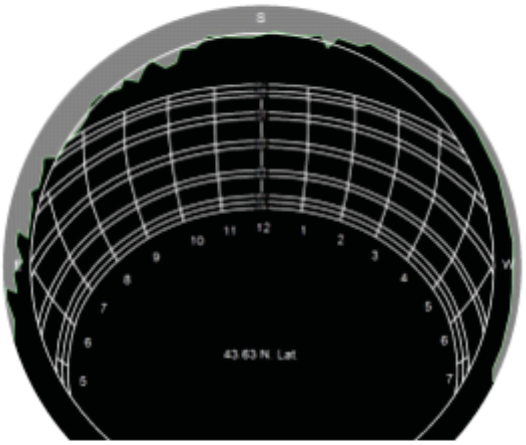
Summary Report

Solar Obstruction Data						
Month	**Unshaded % of Ideal Site Azimuth=180 Tilt=43.63**	**Actual Shaded Solar Radiation Azimuth=135.0 Tilt=43.63 kWh/m²**	**Actual Shaded AC Energy (kWh) Azimuth=135.00 Tilt=43.63**	**Actual Unshaded AC Energy (kWh) Azimuth=135.0 Tilt=43.63**	**Ideal Unshaded AC Energy (kWh) Azimuth=180.0 Tilt=43.63**	**PV Solar Cost Savings 0.17 ($/kWh)**
January	100.00 %	2.91	283.00	283.00	350.00	$48.11
February	100.00 %	3.92	341.00	342.00	395.00	$57.97
March	100.00 %	4.67	438.00	438.00	475.00	$74.46
April	100.00 %	4.84	421.00	421.00	444.00	$71.57
May	100.00 %	5.11	443.00	443.00	458.00	$75.31
June	100.00 %	4.95	405.00	405.00	407.00	$68.85
July	100.00 %	5.68	475.00	475.00	477.00	$80.75
August	100.00 %	5.25	444.00	444.00	469.00	$75.48
September	100.00 %	4.99	419.00	421.00	453.00	$71.23
October	100.00 %	3.67	331.00	343.00	385.00	$56.27
November	100.00 %	2.53	224.00	225.00	277.00	$38.08
December	100.00 %	2.47	237.00	245.00	296.00	$40.29
Totals	**100.00%**	**50.99**	**4,461.00**	**4,485.00**	**4,886.00**	**$758.37**
	Unweighted	**Effect: 91.92%**				
	Yearly Avg	**Sun Hrs: 4.25**				

Notes: This is the 4th of the series of readings taken, moving northeast to southwest.

Notes: images 3087 in my files





(j) Report Waterfront 5

Site Report

Report Name	SPF Report Waterfront Parking 5
Report Date	11/2/2014 4:49:16 PM
Declination	-15d 38m
Location	Lat/Long specified
Lat/Long	43.63 / -70.05
Weather Station	Portland Intl Jetport, ME, Elevation: 46 Feet, (43.650/-70.300)
Site Distance	13 Miles
Report Type	PV
Array Type	Fixed Angle
Tilt Angle	43.63 deg
Ideal Tilt Angle	43.63 deg
Azimuth	135.00 deg
Ideal Azimuth	180.00 deg
Electric Cost	0.17 ($/kWh)
Panel Make	Canadian Solar
Panel Model	CS6P-250P
Panel Count	15
DC Rate (per panel)	250.0 Watts
Unshaded Percent	98.2 %
STC System Size	3.75 kW
DC System Size	3.68 kW
AC System Size	2.95 kW
Inverter Make	Enphase Energy
Inverter Model	M250-60-2LL-S2X (-ZC) (-NA) (240V)
Inverter Count	15
Derate Method	System Setting
DC to AC Derate Factor	0.800
Layout Configuration	Single Picture
Layout Point Count	1

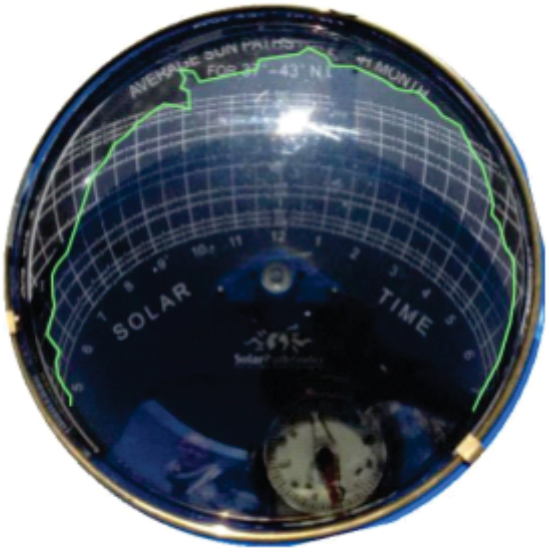
Notes: This is the furthest southwest of all 5 readings taken along the waterfront parking strip, moving northeast to southwest. There is actually a larger space between this reading and the 4th, because there was initially one taken between the two which was abandoned for quality reasons.Like the others in this row, the theoretical array is oriented at 135 degrees do to the nature of both the shoreline and the parking.

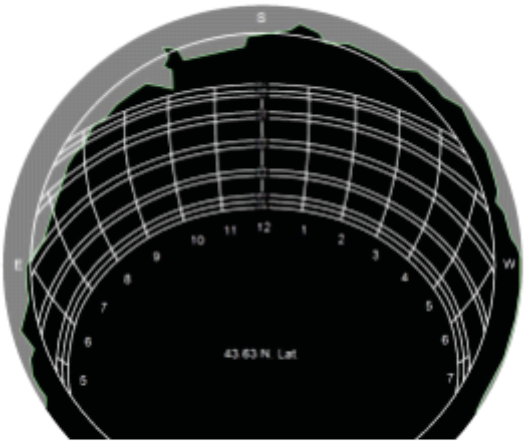
Summary Report

Solar Obstruction Data						
Month	**Unshaded % of Ideal Site Azimuth=180 Tilt=43.63**	**Actual Shaded Solar Radiation Azimuth=135.0 Tilt=43.63 kWh/m²**	**Actual Shaded AC Energy (kWh) Azimuth=135.00 Tilt=43.63**	**Actual Unshaded AC Energy (kWh) Azimuth=135.0 Tilt=43.63**	**Ideal Unshaded AC Energy (kWh) Azimuth=180.0 Tilt=43.63**	**PV Solar Cost Savings 0.17 ($/kWh)**
January	97.58 %	2.82	275.23	283.00	350.00	$46.79
February	98.17 %	3.84	333.68	342.00	395.00	$56.73
March	100.00 %	4.67	438.00	438.00	475.00	$74.46
April	100.00 %	4.84	421.00	421.00	444.00	$71.57
May	100.00 %	5.11	443.00	443.00	458.00	$75.31
June	100.00 %	4.95	405.00	405.00	407.00	$68.85
July	100.00 %	5.68	475.00	475.00	477.00	$80.75
August	100.00 %	5.25	444.00	444.00	469.00	$75.48
September	100.00 %	4.99	419.00	421.00	453.00	$71.23
October	97.65 %	3.56	321.13	343.00	385.00	$54.59
November	96.78 %	2.37	210.00	225.00	277.00	$35.70
December	96.08 %	2.37	227.67	245.00	296.00	$38.70
Totals	**98.85%**	**50.45**	**4,412.71**	**4,485.00**	**4,886.00**	**$750.16**
	Unweighted	**Effect: 90.94%**				
	Yearly Avg	**Sun Hrs: 4.20**				

Notes: This is the furthest southwest of all 5 readings taken along the waterfront parking strip, moving northeast to southwest. There is actually a larger space between this reading and the 4th, because there was initially one taken between the two which was abandoned for quality reasons.Like the others in this row, the theoretical array is oriented at 135 degrees do to the nature of both the shoreline and the parking.

Notes: Photo 3092 in my pictures settings.





O Solar Site Selections - Rationale

Each solar site has been evaluated for its merits and challenges, then ranked in order of ideal site for solar array at this time. 1 = Most potential through 5 = Least potential

Site 1) Solar Canopy - Main Parking

This site was proposed by Nathan in the original concept.

Merits include:

* Shaded parking (noted by a resident at the Library community meeting)
* Minimal view impact
* Potential electric vehicle charging station
* Potential revenue generation for covered parking

Challenges include:

* Shade from nearby trees (factored by the Pathfinder)
* Re-orienting and re-striping parking to optimize solar-gain capacity of car canopy

Development of this site results in reorienting the solar canopy in relation to the current parking configuration to maximize the south-facing exposure. The area outlined (90 ft x 45 ft) accommodates 270 solar panels, configured as 30 panels across, 9 panels high (67.5 kW at 250W/panel). This system produces an estimated 82,000 kWh per year. This production is higher than the energy used from net-metering the municipal accounts.

Financial calculations associated with Site 1 itemize a cost estimate for a solar canopy ($4.50/W installed, as quoted by Revision Energy and Carport Structures), solar potential at the site 14.65% capacity factor, as calculated from Solar Pathfinder data in Appendix N, and additional financial assumptions, which result in a negative net present value.

Rank = 3

Site 2) Solar/Wind Hybrid Lampposts

Again, this site was proposed by Nathan in the original concept. It combined the complementary advantages of seasonal solar and wind resources.

Merits include:

* Complementary advantages of seasonal solar and wind resources
* Aesthetics of ‘sculptural’ small, vertical axis turbines
* No auditory impacts
* Visual and educational (combined with signage) to all ferry passengers

Challenges include:

* Good/fair wind resource (3 meters/s cut in)
* High product cost
* Aesthetics and education over product output choice
* Impracticalities of small-scale wind production and costs

The Team researched several manufacturers and models, ultimately selecting a Sanya model from Urban Green Energy (UGE).

Financial calculations associated with Site 2 calculate the UGE quote with anticipated energy production, the cost totaled $20/W installed price of $20/W. The costs of this option are excessively high.

Rank = 5

Site 3) Solar Canopy - Waterfront Parking

This site was considered during the Team’s Island visit. Solar Pathfinder analysis shows solar visibility is quite good.

Merits include:

* Partially shaded parking
* Excellent solar exposure
* Ideal as-is parking orientation
* Potential electric vehicle charging station
* Potential revenue generation for covered parking

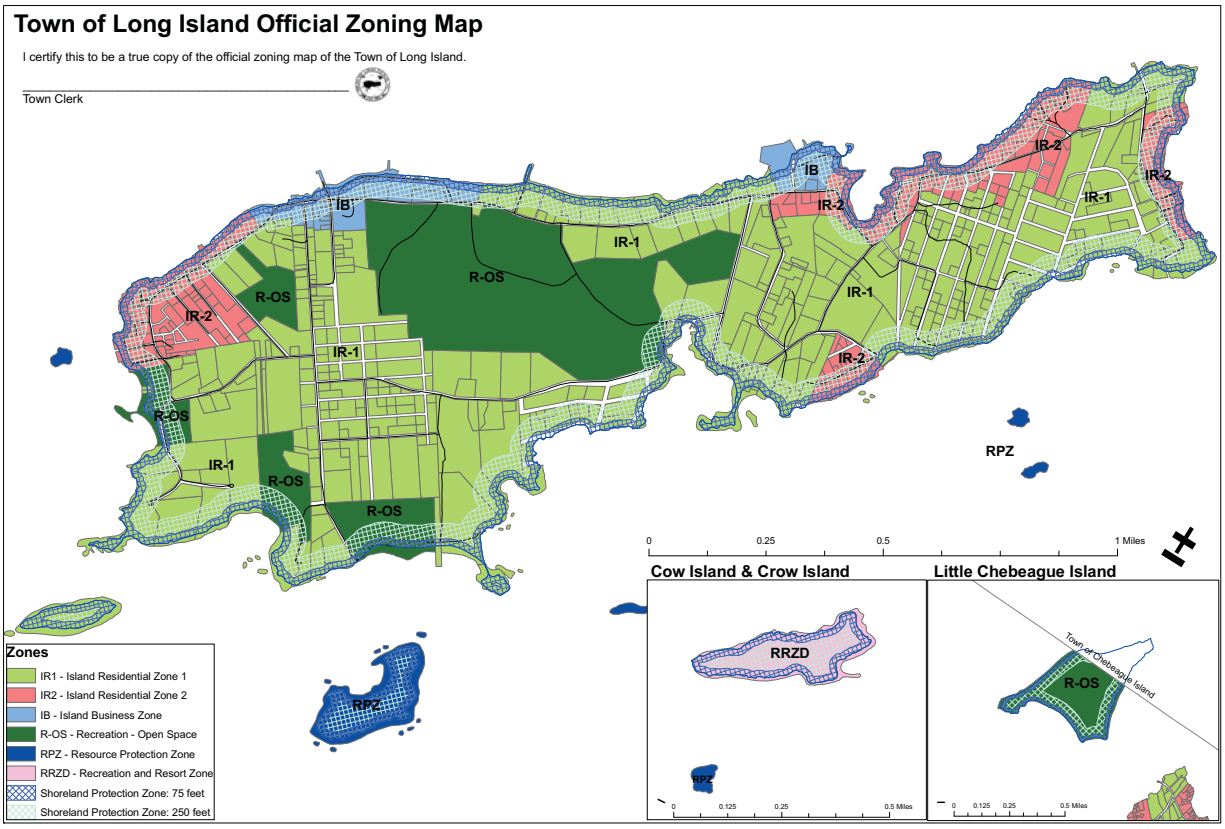
Challenges include:

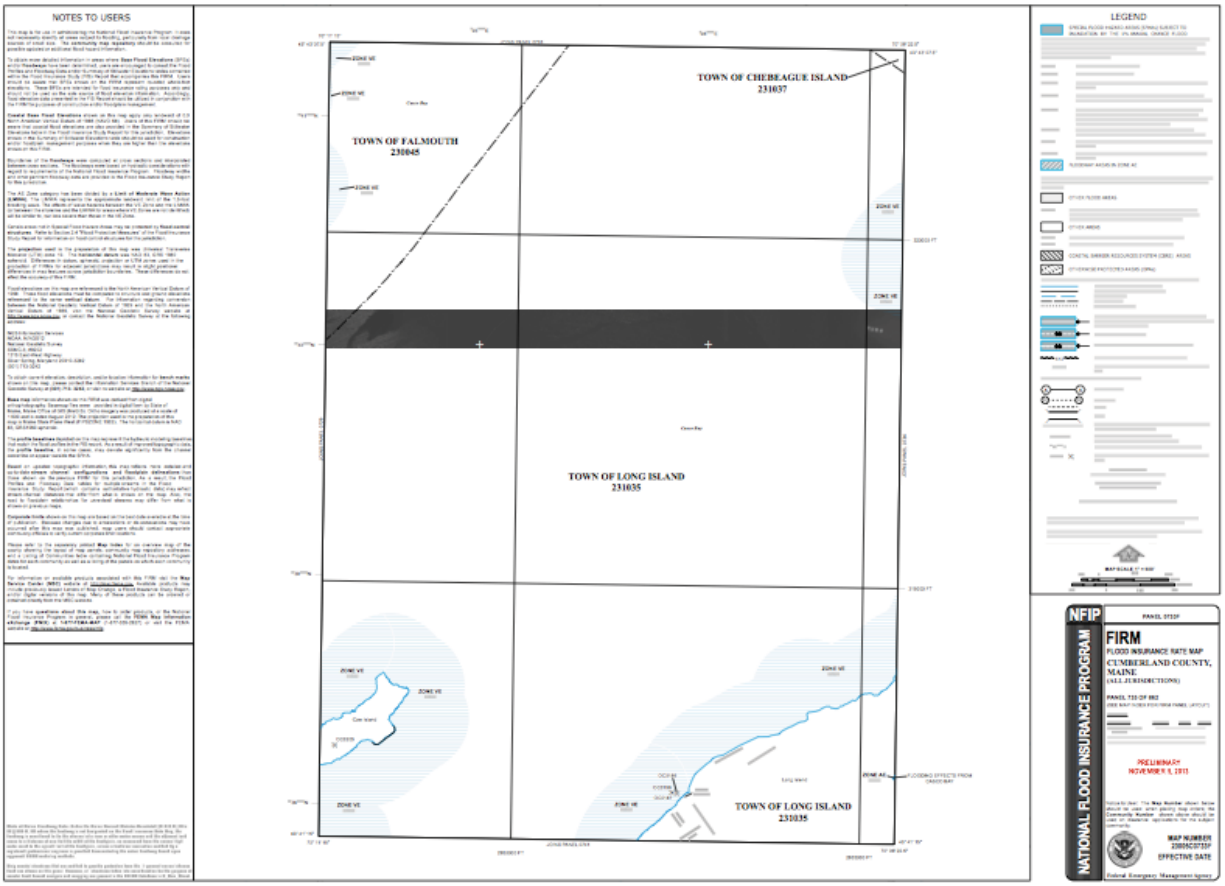
* Higher car canopy structure due to tilt of solar array (southerly slant) and clearance considerations
* Aesthetics due to structure height
* Visual water obstruction from land and sea view sheds
* Seasonal salt spray and resultant ice due to structure’s proximity to water (impact on solar panels and inverters)

The Team did not run financial calculations on Site 3.

Rank = 4

P Town of Long Island Zoning / Flood Insurance Maps




NOTES TO USERS
TOWN OF FALMOUTH
230045
TOWN OF CHEBEAGUE ISLAND
231037
TOWN OF LONG ISLAND
231035
TOWN OF LONG ISLAND
231035
LEGEND
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
CUMBERLAND COUNTY, MAINE
(ALL JURISDICTIONS)
PRELIMINARY
NOVEMBER 9, 2011
MAP NUMBER
23005C0733F
EFFECTIVE DATE
Federal Emergency Management Agency

Q Community-Scale Solar/Wind - Relevant Ordinances

Town of Long Island Ordinances

B. Permitted use.
(4) Accessory uses customarily incidental and subordinate to the location, function and operation of principal uses, subject to the provisions of Article 2 (Definitions) and Article 7 (Town-wide Performance Standards) of this chapter including but not limited to (a) home occupations, (b) private temporary tenting with one (1) tent accessory to a principal residential use, provided that adequate water supplies and sanitation facilities are available in connection with the principal residential use, and (c) roadside stands less than two hundred (200) square feet in floor area for the sale of agricultural products produced on the premises, and the sale of fish and shellfish caught by the occupant of the dwelling or principal structure.
(7) One detached accessory structure with a footprint less than one-hundred (100) square feet shall be permitted on each lot and shall be exempt from side and rear setbacks and shall be permitted without a building permit provided that the Town is notified by submitting a plot plan showing the location of the accessory structure on the property to be kept on file at Town Hall.

E. Dimensional requirements. In addition to the provisions of this chapter, lots in an IR-2 zone shall meet the following minimum requirements:
(1) Minimum lot size except as provided in Article 6 (Non-Conformance Structures, Uses and Lots)
a. Sixty thousand (60,000) square feet for all permitted uses except for animal raising and lodging houses.
c. Lodging houses: Sixty thousand (60,000) square feet for up to six (6) lodging rooms, plus ten thousand (10,000) square feet for each additional lodging room in excess of six (6).
d. Where an existing subsurface wastewater disposal system serving an existing structure requires replacement, the replacement system shall meet the requirements of Maine Subsurface Wastewater Disposal Rules. The land area requirements of this section shall not apply to such a replacement system.
(2) Minimum street frontage: all structures, including accessory structures, shall not cover more than 15% of the area of the lot which is to be built upon or otherwise improved.
(6) Maximum structure height: Principal or attached structure: Thirty-five (35) feet. Accessory detached structure: Eighteen (18) feet.

Excerpt/summary of Article 59, regarding Wind Energy

In May 2009 the Town of Long Island passed an ordinance for small wind energy conversion systems (SWECS) at Article 59 (page 23 begin). Pertinent rules include:

* 70’ or less to blade tip at highest point; 20’ above ground to blade tip at lowest point
* minimum lot area 20,000sf
* comply with minimal shoreland zone setbacks and placed in legally existing clearing. Any additional vegetation removal must comply with vegetation removal provisions within ordinance
* additional permits may be required from DEP, federal, FAA, PUC and DOE
* architectural wind system permitted with applicable fed, state and local laws and regulations and at maximum of 15’ above maximum building height as defined in Article 3 zoning district standards
* sound level not to exceed 50 dBA at property boundary line of proposed site
* no disruptive electromagnetic interference
* non-reflective, non obtrusive finish (galvanized steel, brushed aluminum, or white) as was originally applied by the manufacturer, unless otherwise required by the Federal Aviation Administration)
* design of buildings and related structure use materials, colors screening and landscaping that blends SWECS to natural setting, existing environment and structures
* SWECS not used for advertising except for identification of manufacturer (placed on cover of electric generator of SWECS or unobtrusive nameplate)
* SWECS connect to electric to comply with Title 35-A and 65-407 PUC Rule 313, *Consumer Net Energy Billing*
* Building permit required and notification of abutters within 250’ of property; Site plan presented to Planning Board with items a-e, location plan materials a-g, document materials a-e, fee
* Permits expire if SWECS not installed and functioning within twelve months of permit issue

Community wind and solar may be eligible for PACE loan financing, as established in Long Island’s Property Assessed Clean Energy (PACE) Ordinance (adopted May 14, 2011), Chapter 16, Articles I-V.

Town of Long Island Town Ordinances (revised 5/10/14), Chapter 30, Road and Street Construction Standards 1-6.3 specific to the Town parking lot site, compliance with serve to minimize environmental and aesthetic impacts and to minimize costs to the community. Street Open permits are required with any excavation for electric cables, etc. In Chapter 14, Land Use Ordinance, 3, 3a and 3b., parking spaces are approximately 10 feet wide and twenty feet long, and internal travel aisle are about twenty feet wide, excepting 38 parking spaces at forty feet long for a vehicle and boat trailer, when determining proposed parking facilities.

Review of **Maine Revised Statutes**, Title 35A: The Maine Wind Energy Act, Sections 3401-3404 and Sections 3451-3459, offers regulatory guidelines about wind projects.

Additionally, Maine Revised Statutes, Title 36: Community-Based Renewable Energy, Sections 3602-3609 describes community-based renewable energy. It appears Long Island may set up a variety of “Qualifying local owner,” structures (individuals,

municipalities, quasi-municipal corporations, schools, etc.) with at least 51% ownership in a locally owned electricity generating facility and which does not exceed 100 megawatts.

Another qualifying owner structure is “Program participant,” which criteria, according to Section 3603, requires a 50 megawatt cap as the installed generating capacity for combined program participants, of which each participant may not exceed 10 megawatts. This program is eligible for a long-term contract and a REC multiplier. Under Section 3606 the value of the energy credit multiplier is 150% of amount of electricity generated by a program participant, and are used in satisfying portfolio requirements (Section 3210.3 and .3A).

Publicly owned land, water and facilities are available to ‘political subdivisions of the State’ for development and operation (or lease to other qualifying owners) of renewable energy projects, as cited in Section 3608.2.

Title 37: Rural Electrification Cooperatives, beginning at Section 3701, discusses cooperative regulations for rural electrification. Title 41: Maine Municipal and Rural Electrification Cooperative Agency Act, Sections 4101-4176 detail further regulations in connection with municipalities.

Siting and developing a community-supported wind project, in consideration of audible sound generated from turbine blades is reviewed in Maine State Legislature Title 38: Waters and Navigation, Subchapter 1: Environmental Protection Board, Article 6: Site Location of Development, Section 481, paragraph 4. The Legislature recommends the geographic restriction and frequently transient impact best regulated through the governance of the local municipality, according to the municipality’s economic development and land use plans.

(www.mainelegislature.org/legis/statutes)

In the event the project scope generated considerable electricity, well beyond Long Island’s consumption, the Federal Energy Regulatory Commission (FERC) regulates the transmission and wholesale sales of electricity in interstate commerce.

Maine Revised Statutes (2013), Title 35-A: Public Utilities, accordingly, the State supports solar energy efforts through monitoring, economic development programs and resources, public policy and generation goals in the infrastructure, utility-rate structures and siting, permitting, financing and construction of research and manufacturing facilities to benefit ratepayers.

Maine Revised Statutes (2013), Title 35-A: Public Utilities, Section 3473.1, specific measures to support solar energy include monitoring developments in solar energy, market trends, ratepayer costs and benefits, peak-load minimization on transmission and distribution systems, and peak-hour market prices. A second measure (Section 3473.2) includes the economic development of solar energy within existing programs

and resources such as the Small Enterprise Growth Program, Maine Technology Institute, Maine Rural Development Authority, Finance Authority of Maine and the Department of Economic and Community Development. These resources promote investments in solar energy development, generation and manufacturing.

Title 35-A, Section 3474.1 and .2 determine public policy and generation goals through support of infrastructure, utility-rate structures and siting, permitting, financing and construction of research and manufacturing facilities to benefit ratepayers. Goals include ensuring a. renewable-energy generation contributes to generation capacity through increasing private investment; b. solar thermal production reduces imported energy dependence; c. solar electric mitigates more costly transmission and distribution investments needed for system reliability; d. solar electric production benefits all ratepayer incomes; e. business and residence solar use increases; and f. the solar manufacturing and installation workforce increases.

In review of site considerations for Gateway and Community Solar/Wind projects, potential sites do not fall under Title 38: Waters and Navigation, Article 5-A: Natural Resources Protection Act, Section 480-A, whereby the State recognizes its rivers and streams, great ponds, fragile mountain areas, freshwater wetlands, significant wildlife habitat, coastal wetlands and coastal sand dunes systems as resources of state significance for scenic beauty, unique characteristics, unsurpassed recreational, cultural, historical and environmental value, past and future.

Maine State public advocacy, currently appointed to Tim Schneider, supports ratepayers‘ interests before the Maine Public Utilities Commission is reviewed in Title 17, Section 1701-1713.

R Financial Calculations and Spreadsheets

Site: System Cost Estimates (Nov 11, 2014)

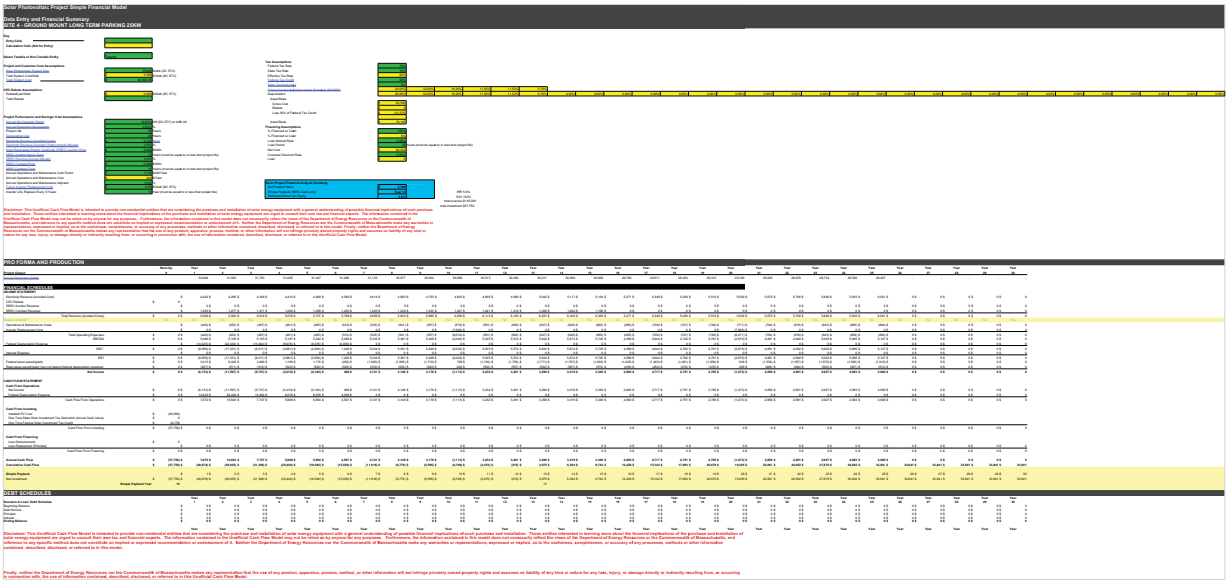
SYSTEM COST ESTIMATES – WHARF GATEWAY PROJECT						
Site	System Type	Cost Estimate ($/W)	System Size (kW)	Cost Estimate (total $)	Notes	Source
USED FOR ISLAND INSTITUTE PRESENTATION CALCULATIONS						
Site 1: MAIN PARKING LOT			15			
	General – PV 10-100kW	3.82	10-100			http://www.nrel.gov/analysis/tech_lcoe_re_cost_est.html
	Case – Solar Canopy	5.3	9.54	51000		http://www.kingarthurflour.com/press/solar-charging-station.html
	GE Est – Solar Carport	7.1	25	177407		https://www.geindustrial.com/solar-carport-calculator
	Case – Solar Carport	5.5	2.8	15400	Case from prez from Mississippi, built himself?	http://www.mississippi.org/assets/docs/energy/electric-vehicle-solar.pdf
	Solar Canopy	5.82	25		not incl solar EV charger, etc.	https://www.geindustrial.com/solar
Site 2: PEER LAMPPOSTS			3			
	UGE SLS	20	0.45	9000		UGE E-mail

	General – PV/Wind Hybrid System	6.44	0.3			http://siteresources.worldbank.org/EXTENERGY/Resources/336805-1157034157861/ElectrificationAssessmentRptAnnexesFINAL17May07.pdf
	General – PV/Wind Hybrid System	5.42	100			http://siteresources.worldbank.org/EXTENERGY/Resources/336805-1157034157861/ElectrificationAssessmentRptAnnexesFINAL17May07.pdf
	General – Wind <10kW	7.9	<10kW			http://www.nrel.gov/analysis/tech_lcoe_re_cost_est.html
Site 3: WATERFRONT PARKING			**15**			
	General – PV 10-100kW	3.82	10-100			http://www.nrel.gov/analysis/tech_lcoe_re_cost_est.html
	Solar Canopy (Anna's Est.	~7.5				
	Solar Canopy	6	25		not incl solar EV charger, etc., slightly more according to Anna	https://www.geindustrial.com/solar

Site 4: LONG TERM PARKING			**10**			
	General – PV <10kW	3.91	<10kW			http://www.nrel.gov/analysis/tech_lcoe_re_cost_est.html
	General – PV 10-100kW	3.82	10-100			http://www.nrel.gov/analysis/tech_lcoe_re_cost_est.html
	Est – Rooftop	3.06	15	45900		http://www.revisionenergy.com/solar-calculator.php
	Ground Mount (Anna's Est.)	3.3				Anna
Site 5: TOWN STORAGE PARKING						
	Solar Canopy	5.82	25		not incl solar EV charger, etc.	https://www.geindustrial.com/solar
SITE 5: TRANSFER STATION – Wind						
	General – Wind 10-100kW	6.39	10-100			http://www.nrel.gov/analysis/tech_lcoe_re_cost_est.html
	Northwind 100					
TRANSFER STATION – Solar						

	General – PV 10–100kW	3.82	10–100			http://www.nrel.gov/analysis/tech_lcoe_re_cost_est.html
OTHER						
	Wholesale Solar – wholesale panels	1.57	7.2–12		(w/o shipping, racking, installation, etc.)	http://www.wholesalesolar.com/StartHere/GRIDINTBallparkCost.html

Site 4 Ground Mount - Long Term Parking
25kW (Simple Calculator)



Solar Photovoltaic Project Simple Financial Model

Data Entry and Financial Summary
SITE 4 - GROUND MOUNT LONG TERM PARKING 25KW

Key

Entry Cells →	
Calculation Cells (Not for Entry)	

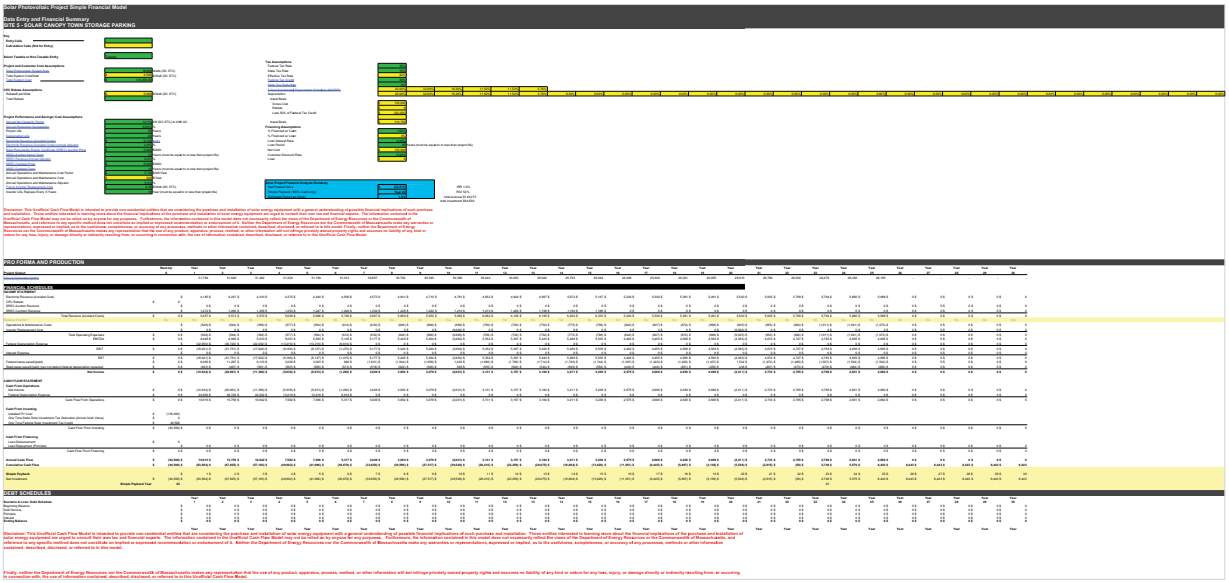
Select Taxable or Non-Taxable Entity	Taxable	
Project and Customer Cost Assumptions		
Solar Photovoltaic System Size	25000	Watts (DC STC)
Total System Cost/Watt	$ 3.300	$/Watt (DC STC)
Total System Cost →	$ 82,500.00	
CEC Rebate Assumptions		
Rebate$ per/Watt	$ -	$/Watt (DC STC)
Total Rebate		
Project Performance and Savings/ Cost Assumptions		
Annual Net Capacity Factor	14.65%	kW (DC STC) to kWh AC
Annual Production Degradation	0.50%	%
Project Life	25	Years
Depreciation Life	20	Years
Electricity Revenue (Avoided Costs)	$ 0.132	$/kWh
Electricity Revenue (Avoided Costs) Annual Adjustor	2.0%	%
Solar Renewable Energy Certificate (SREC) Auction Price	$ 0.040	$/kWh
SREC Auction Opt-In Term	15	Years (must be equal to or less than project life)
SREC Revenue Annual Adjustor	0.0%	%
SREC Contract Price	$ 0.040	$/kWh
SREC Contract Term	15	Years (must be equal to or less than project life)
Annual Operations and Maintenance Cost Factor	$ 17.59	$/kW/Year
Annual Operations and Maintenance Cost	$ 440	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.30	$/Watt (DC STC)
Inverter Life, Replace Every X Years	10	Year (must be equal to or less than project life)

Tax Assumptions						
Federal Tax Rate	35%					
State Tax Rate	10%					
Effective Tax Rate	42%					
Federal Tax Credit	30%					
State Tax Deduction	0%					
5 Year Accelerated Depreciation Schedule (MACRS)	20.00%	32.00%	19.20%	11.52%	11.52%	
Depreciation	20.00%	32.00%	19.20%	11.52%	11.52%	
Asset Basis						
Gross Cost	$ 82,500					
Rebate	$ -					
Less 50% of Federal Tax Credit	$ (12,375)					
Asset Basis	$ 70,125					
Financing Assumptions						
% Financed w/ Cash	100%					
% Financed w/ Loan	0%					
Loan Interest Rate	4.00%					
Loan Period	20	Years (must be equal to or less than project life)				
Net Cost	$ 82,500					
Customer Discount Rate	5.00%					
Loan	$ -					

Solar Project Financial Analysis Summary			
Net Present Value	**$ 2,390**		
Simple Payback (100% Cash only)	**Year 13**	IRR	5.6%
Estimated Return on Equity	**5.6%**	ROI	152%
		total revenue	$145,363
		total investment	$57,750

5.76%							
5.76%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Site 5 Solar Canopy - Town Storage Parking
30kW (Simple Calculator)



Solar Photovoltaic Project Simple Financial Model

Data Entry and Financial Summary
SITE 5 - SOLAR CANOPY TOWN STORAGE PARKING

Key

Entry Cells →		
Calculation Cells (Not for Entry)		

Select Taxable or Non-Taxable Entity	Taxable	

Project and Customer Cost Assumptions

Solar Photovoltaic System Size	30000	Watts (DC STC)
Total System Cost/Watt	$ 4.500	$/Watt (DC STC)
Total System Cost →	$ 135,000.00	

CEC Rebate Assumptions

Rebate$ per/Watt	$ -	$/Watt (DC STC)
Total Rebate		

Project Performance and Savings/ Cost Assumptions

Annual Net Capacity Factor	12.1%	kW (DC STC) to kWh AC
Annual Production Degradation	0.50%	%
Project Life	25	Years
Depreciation Life	20	Years
Electricity Revenue (Avoided Costs)	$ 0.132	$/kWh
Electricity Revenue (Avoided Costs) Annual Adjustor	2.0%	%
Solar Renewable Energy Certificate (SREC) Auction Price	$ 0.040	$/kWh
SREC Auction Opt-In Term	15	Years (must be equal to or less than project life)
SREC Revenue Annual Adjustor	0.0%	%
SREC Contract Price	$ 0.040	$/kWh
SREC Contract Term	15	Years (must be equal to or less than project life)
Annual Operations and Maintenance Cost Factor	$ 17.59	$/kW/Year
Annual Operations and Maintenance Cost	$ 528	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.30	$/Watt (DC STC)
Inverter Life, Replace Every X Years	10	Year (must be equal to or less than project life)

Tax Assumptions					
Federal Tax Rate	35%				
State Tax Rate	10%				
Effective Tax Rate	42%				
Federal Tax Credit	30%				
State Tax Deduction	0%				
5 Year Accelerated Depreciation Schedule (MACRS)	20.00%	32.00%	19.20%	11.52%	11.52%
Depreciation	20.00%	32.00%	19.20%	11.52%	11.52%
Asset Basis					
Gross Cost	$ 135,000				
Rebate	$ -				
Less 50% of Federal Tax Credit	$ (20,250)				
Asset Basis	$ 114,750				
Financing Assumptions					
% Financed w/ Cash	100%				
% Financed w/ Loan	0%				
Loan Interest Rate	4.00%				
Loan Period	20	Years (must be equal to or less than project life)			
Net Cost	$ 135,000				
Customer Discount Rate	5.00%				
Loan	$ -				

Solar Project Financial Analysis Summary			
Net Present Value	**$ (22,917)**	IRR	1.0%
Simple Payback (100% Cash only)	**Year 23**	ROI	52%
Estimated Return on Equity	**1.0%**	total revenue	$144,073
		total investment	$94,500

5.76%							
5.76%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Definitions

Kilowatt-hours (kWh)	Unit of energy. This is a measure of how much energy is consumed by a home or facility. It is also a measure of how much electricity is produced by a solar PV system. The amount of energy consumption or production is measured by an electric meter.
Solar System	The solar photovoltaic (PV) system. This includes your panels (modules), inverter, and meter which connects you to the utility.
Estimated Optimal Annual Generation (kWh) **optimal fixed south facing free from shading location**	The best case scenario for how much electricity a solar PV system will produce. PV systems will produce more or less electricity depending on several factors. For example, a system will produce less energy if the panels are fixed (e.g. to a roof) than if they are on an axis that tracks the sun throughout the day. Another factor is orientation. The more the system is able to face due south, the more it should produce. Tilt angle also impacts production. The closer a system's tilt is to its latitude the more it will produce. An optimal system in Massachusetts that is fixed, faces due south (180 degrees) and has a tilt of 42 degrees.
System Size **kilowatts (kW)**	Kilowatts are a measure of power. A kilowatt is 1,000 watts. In this case, it describes the size of the solar PV system. A single solar PV panel might be rated at 180 watts. If a system uses 10 panels rated at 180 watts each, the system size will be 1800 watts, or 1.8 kW.
Annual Net Capacity Factor	This is a ratio between the amount of energy produced by your solar PV system and its optimum nameplate (labeled) production capability. A 12.8% net capacity factor is average for solar PV systems in Massachusetts. This value varies by the angle of the system, its orientation, and the amount of shading. If a solar PV system had the sun shining on it every day, 24 hours per day at the optimal tilt and orientation with no shade then that system would have a 100% capacity factor, in other words, it would produce its rated output.
Annual Production Degradation	Over the course of the life of the PV system, its production capability will decrease as it deteriorates to a degree over time. Our default assumption is that this degradation will be 0.5% per year.
Depreciation Life	Depreciation is the reduction in the value of an asset due to usage, passage of time, wear and tear, technological obsolescence or other factors. Depreciation life is the "useful life" of the system, meaning the estimated length of time the system will provide an economic benefit.
Electricity Revenue (Avoided Costs)	This is the price per kWh that you will save on your electricity bill using this solar PV system. The default is $0.18/kWh as this is a state average price for electricity.
Electricity Revenue (Avoided Costs) Annual Adjustor	This model assumes that the cost of electricity will increase at 5% per year, therefore your savings from avoided electricity costs will also increase at 5% a year.
Solar Renewable Energy Certificate (SREC) Auction Price	Solar Renewable Energy Certificates (SRECs), also known as green tags, Solar Renewable Energy Credits, are tradable environmental commodities in Massachusetts which represent proof that 1 megawatt-hour (MWh) of electricity was generated from an eligible renewable energy resource. These certificates may have a value and they can be sold and traded so that the owner of the SREC can claim to have purchased renewable energy. Their default value is set at $.285/kWh, which is the price owners will receive for their SRECs if sold through the Solar Credit Clearinghouse Auction Account.
SREC Auction Opt-In Term	The model uses a default term of 10 years. This term is based upon the length of the Auction Opt-In Term that all projects qualified in 2010 will receive. All projects with an Opt-In Term of 10 years will be eligible to sell SRECs generated during their Opt-In Term by depositing them in the end of year Solar Credit Clearinghouse Auction Account. The Auction is expected to be a measure of last resort for projects that have not signed bilateral contracts with compliance entities that are required to purchase SRECs by the end of the compliance year.

SREC Revenue Annual Adjustor	This models allows the value of RECs to change by this percentage each year
SREC Contract Price	The price of SRECs as agreed upon in a bilateral contract with a compliance entity or other entity purchasing SRECs.
SREC Contract Term	The term of the bilateral contract with a compliance entity or other entity purchasing SRECs.
Future Inverter Replacement Cost	A solar inverter is a component of a PV system that changes the direct current (DC) electricity from the PV array into alternating current (AC) for use with home appliances or any AC load. The life of a solar PV system's inverter is less than the life of the PV panels and will likely need to be replaced during the lifetime of the system which can be 25 years or more. This model assumes the default cost to replace the inverter will be $0.75/watt.
Annual Generation (kWh)	This is the estimated amount of energy that your solar PV system will produce in kilowatt hours (kWh) each year.
Total System Cost	Total System Cost includes all elements of the installation including design, equipment, labor, permitting, interconnection, etc. In the case of taxable commercial entities, the Total System Cost should include Massachusetts sales tax on the equipment