WISERCAPITAL

2015 Solar Economy Barometer
Research, Key Findings, and Methodology
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Introduction:

Across the US, there is untapped solar capacity among the commercial sector. As the residential and utility scale solar markets have taken off, commercial has followed one step behind. According to GreenTech Media, the U.S. commercial segment did see 1,036 MW of solar installations in 2014 and they forecast the commercial market to grow at 40% over its 2014 total. That said, most of these projects were cash purchases or focused in the large commercial sector.

The industry as a whole believes that there remains a deluge of untapped potential in the small to medium scale, distributed generation, third party financed, commercial solar market. But what is that potential? Where is it located? And exactly how much more solar are we talking about?

Wiser Capital worked to answer these questions and determine market potential for mid-sized commercial solar in the Northeast United States. A solar market must have adequate available capacity to entice installers to set up shop, potential savings to the host facilities and a large enough pool of investment opportunities for financiers to dedicate resources to the region.

In order to understand the region's size in regards to solar capacity, potential savings, and investment opportunity, Wiser Capital's Market Study takes into consideration the available commercial roof space, utility rates, an average cost per watt to install solar, and regional incentives. Together these factors build a picture of the regional market, while dialing in details for key markets: Massachusetts and New York.

Each section, capacity, savings, and investment potential, is broken into two subsections: key findings and methodology. Key finds will briefly describe the main take-away points for each section. Methodology walks through a step-by-step guide on how the findings were derived.

The conclusion of this paper is that the Northeast is ripe for solar investments and should see substantial market share in the coming years.

Capacity in the Mid-Scale Commercial Solar Market

Key Findings

In solar, the size of a state and its longitude position on the globe are not necessarily correlated with its solar capacity. Instead, for distributed solar, the number of buildings and population are much more important.

Utilizing Environment America's (EA) 2012 report "EA Star Power" the methodology outlined below, Wiser finds 274,637 commercial buildings as appropriate for solar in the Northeast region. Assuming an average mid-scale solar system size of 350 kW, this assessment yields over 94,733 MW of potential solar installations.

Given their geographical size and land development characteristics its not surprising New York, Pennsylvania, and Massachusetts hold the highest number of commercial buildings with solar potential. But available roof space does not make a market in and of itself. While most of the key findings will be generalized for the Northeast, New York and Massachusetts have been selected as case studies due to the general attractiveness of their respective markets.

Overall, 29.71% of the commercial buildings optimal for solar in the Northeast are located in New York. Massachusetts also has a robust potential market share and holds 17.09% of all solar optimal commercial buildings in the region. Given this number of commercial buildings within the defined niche market (mid-scale commercial solar between 50kW to several MW), we can assess the market potential in this untapped sector and region.

Methodology

To determine the commercial rooftop real estate suitable for this market, Wiser Capital first drew upon Environment America's (EA) 2012 report "EA Star Power" utilizing US Census Bureau data to isolate the number of commercial rooftops by state. Using Environment America's previous 2003 report, Wiser derived a growth calculation to find year-over-year changes. Wiser Capital found a 14% difference in number of buildings between 2003 and 2012. Given the nine-year period and assuming linear growth, an average 1.6% increase was calculated year-over-year in number of commercial buildings within the US. By isolating the dataset to represent the Northeast, Wiser Capital estimates an increase of 39,262 buildings between 2012 and 2015, from

805,000 total commercial buildings to 844,262 by 2015.[1]

The total number of buildings in the region provides the starting point to assess "solar friendly" rooftops in the medium scale market. Wiser Capital defines this market as projects from 50 kilowatts (kW) to approximately 2 megawatts (MW). Assuming that 1 kW of solar can fit on 100 square feet, the market should be limited to buildings with over 5,000 square feet of roof space (Figure 1). The EA sample has a median of 5,900 square feet. Hence we draw the conclusion that the median system size of this dataset is roughly 59 kW, and only 50% of commercial rooftops of the dataset apply.

Figure 1. EIA's 2012 CBECS Survey Data

	Number of buildings (thousand)	Total floorspace (million square feet)	Mean square feet per building (thousand)	Median square feet per building (thousand)
Northeast	805	15,569	19.3	5.9

By isolating projects 59 kW and larger, we can assume that the total number of buildings in the market segment was 402,500 in 2012. All of these buildings, however, will not be solar friendly due to structural concerns, configuration, shading, or previously installed HVAC and other mechanical equipment. To further refine the estimate of commercial rooftops with suitable conditions to host a solar system, Wiser Capital utilized NREL's methodology citing the work of Denholm and Margolis (2008b) that approximately 65% of commercial rooftop area is available to host solar panels in "cool" regions of the United States. The table below highlights the estimated number of commercial rooftops within the Northeast region that have potential to host solar in 2015 accounting for the year to year growth of 1.6% and 65% accessibility factor (Figure 2 and Figure 3).[2]

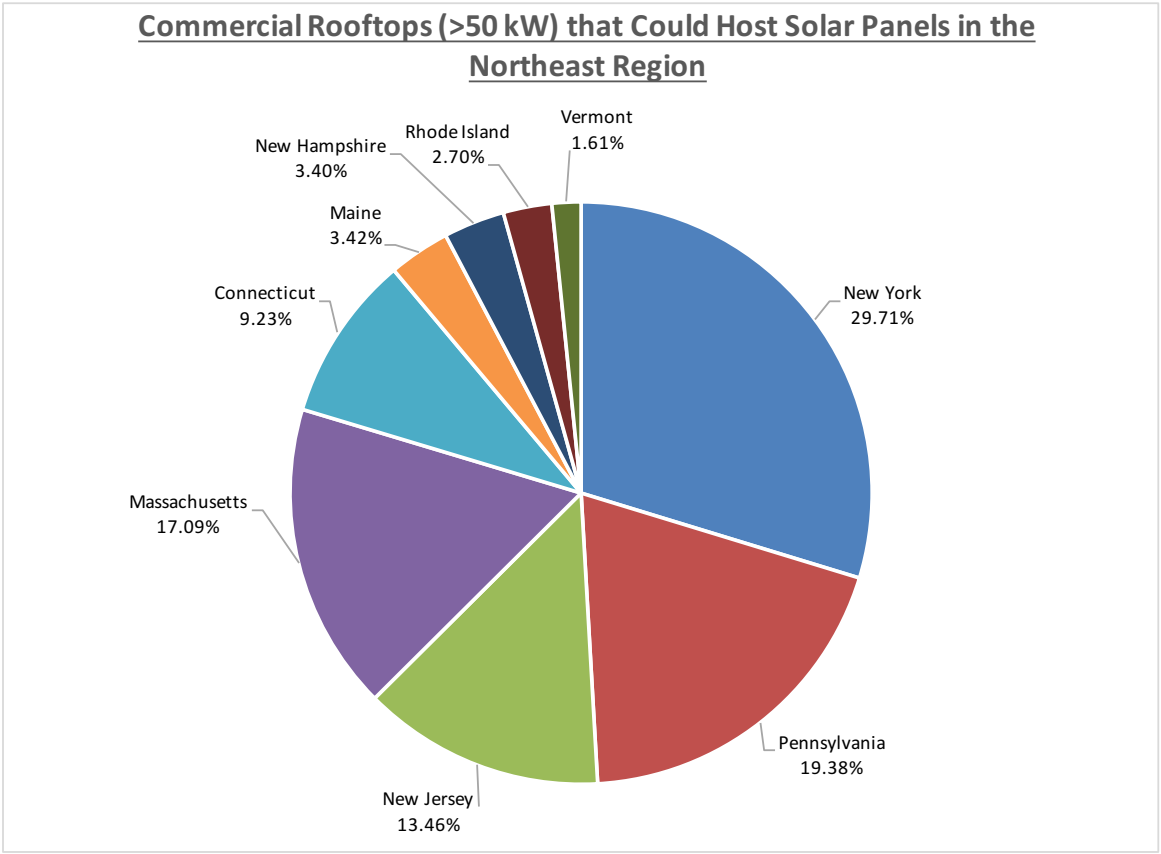
[1] Wiser Capital defines the Northeast to be New York, Pennsylvania, New Jersey, Massachusetts, Connecticut, Maine, New Hampshire, Rhode Island, and Vermont

[2] Due to rounding and unclear definitions of "Northeast" among the studies, slight variations in available building space is expected. Wiser Capital's calculations had a percentage error of 0.09% compared with EA's findings regarding total roof space available for solar. Northeast is defined as: New York, Pennsylvania, New Jersey, Massachusetts, Connecticut, Maine, New Hampshire, Rhode Island and Vermont.

Figure 2.

Estimated Commercial Rooftops (>50 kW) that Could Host Solar Panels	
State	**2015**
New York	81,604
Pennsylvania	53,222
Massachusetts	46,938
New Jersey	36,963
Connecticut	25,357
Maine	9,388
New Hampshire	9,327
Rhode Island	7,417
Vermont	4,421
TOTAL	**274,637**

Figure 3.



Ultimately, we derive a total of 274,637 commercial rooftops that could host a solar array larger than 59kW in the Northeast in 2015.

Extrapolating Wiser Capital's current average project size of 350 kW[3] over the Northeast and accounting for the cumulative solar capacity already installed (as of May 2015) on commercial facilities, this yields a total market of 94,733 MW in the region. The market in New York would comprise 29.71% of the Northeast with 28,401 MW potential and Massachusetts comprises 17.09% with over 15,975 MW untapped (Figure 4).

Figure 4.

State	Commercial Rooftops that Could Host Solar Panels (2015)	kW Solar Potential	Cumulative kW Already Installed	Total Untapped kW Market
New York	81,604	28,561,551	160,726	28,400,825
Pennsylvania	53,222	18,627,530	80,315	18,547,215
Massachusetts	46,938	16,428,228	452,809	15,975,419
New Jersey	36,963	12,937,207	614,307	12,322,900
Connecticut	25,357	8,874,841	56,278	8,818,563
Maine	9,388	3,285,646	3,895	3,281,751
New Hampshire	9,327	3,264,539	4,419	3,260,120
Rhode Island	7,417	2,596,104	3,645	2,592,459
Vermont	4,421	1,547,385	13,817	1,533,568
TOTAL	**274,637**	**96,123,030**	**1,390,211**	**94,732,819**

[3] Average project size is taken from Wiser Capital's current project portfolio.

Monetary Savings the Mid-Scale Commercial Solar Industry Can Bring to the Northeast Economy

Key Findings

Importantly, solar is increasingly competing with, and beating, utility electricity prices in many regions of the country. In the residential market, 11 states have distributed solar electricity cheaper than utility prices. It's anticipated than with the next three years, the list will grow to 28.

Solar needs to make economic sense for all of the parties involved, from the owner and installer, to electricity purchaser (if different from owner). For third-party owned systems, the economic hurdle for the electricity purchaser is the ability to lock in a lower cost per kilowatt hour (kWh) of electricity than the buyer is currently paying to their local utility. While there are other factors, such as demand charge reduction and tariff flipping to optimize the time of solar production and utility rate charges, to simplify the assessment we modeled savings with a solar system against the blended per kWh utility rate[4]. We also assumed that the host would remain on their existing utility rate (no "tariff flipping"). This blended utility rate, or price threshold that a solar power purchase agreement (PPA) would need to undercut to yield savings is only one variable of the formula driving the economic case for solar. The PPA rate itself, along with the tax benefits and any other applicable rebates and state and sub-state level performance based incentives, are the means by which the third-party investor is repaid on their investment. Thus, the installation cost, as well as other incentives, and the solar resource (kWh electricity produced per kW unit of solar) also are critical elements needed to form a financeable PPA that will offer the mid-scale commercial business in the Northeast significant savings.

In several Northeast states, Solar Renewable Energy Certificates (SRECs) are a key policy incentive providing a market responsive monetary value to "green" sources of generation that do not produce negative externalities, including air pollution and greenhouse gas emissions. Given Massachusetts's strong SRECs market, an attractive PPA rate of 12 c/kWh with a low annual escalator of 0.25% can be offered against the statewide utility average blended rate of 14.83 c/kWh and annual utility price escalation of 2.09%. Using the methodology outlined below, the average 350 kW system at $3.07/watt to install for a commercial entity in Massachusetts where solar offsets ~80% of the entities' consumption (roughly 35,035 kWh solar electricity produced per month) would save $12,170 at the end of their first year, reducing the company's electrical utility bill by 17.75%. Assuming Massachusetts' utility prices continue to increase at the rate of

[4] A blended utility rate is derived by taking the total cost of power and dividing it by the total kWh used. Electricity charges, demand, taxes and fees are all included.

2.09% year-over-year, Wiser Capital projects cumulative savings of $999,763 over the PPA's 25-year term.

New York state has a higher average utility charge of 15.64 c/kWh. New York does not have an SREC market, instead it employs a three-year performance based incentive. Using the average system size of 350 kW system offsetting 83% of total electricity consumption,[5] a host facility could still recognize savings, but not unless installation costs are lower than the Massachusetts case. Given the state's block structure incentives, and factors needed to yield investor returns while saving a commercial entity money, installation costs would preferably be $2.62 per watt or lower. With these data points, Wiser Capital finds a PPA rate of 13.5 c/kWh and an escalator of 0.5% for a commercial entity located in the Consolidated Edison (Con Ed) service territory. For businesses located in the "Rest of the State" as defined by NYSERDA, the PPA rate could reach 15.1 c/kWh with the same 0.5% escalator. With these PPA rates, businesses in the Con Ed territory could potentially see savings of $9,293 in year one and over $1 million over the 25-year time frame while businesses that lie in the rest of the state could be saving $2,377 in year one and $833,248 through year 25. These variations in savings are due to the block incentive structure New York has in place, offering different incentive values to Con Ed customers and customers living in the rest of the state.

Methodology

There is little transparency in cost per watt data on a per state and system size basis due to market competition. Open PV is a database where installers and solar system owners can upload their zip code, state, installation date, system size, and system costs onto the Open PV site and subscribers can sort through each sample project to get a better understanding of installation pricing. Using Open PV datasets, we isolated projects with system sizes between (100 kW – 350 kW) built in 2014 in the Northeast region. After accounting for system size and geographic requirements, there were 26 Northeast 2014 projects in the data set,[6] with an average installation price of $3.36 per watt. The size of the data set creates limitations in the ability to generalize these findings, but due to a general lack of accessible data it was utilized. Additional cost data would improve the study moving forward.

Using average cost per watt data from 2011 - 2013, Wiser Capital estimated an average year-to-year change in cost per watt pricing. On average, the installation price decreased 8.6% year-over-

[5] New York has better solar insolation, therefore the same size system can offset larger electricity usage.
[6] Wiser Capital removed two outlier projects located in Connecticut that had system costs of over $9 per watt. Had those projects been left, the data set would have had 28 projects with an average cost per watt of $3.81.

year in the Northeast region assuming a linear rate. This decrease follows with GreenTech Media's US wide estimate of 6% decrease year-over-year for the commercial sector, recent publications by Utility Dive claiming a 10% decrease and Lawrence Berkeley National Laboratory stating a decrease of 6% to 13% in 2015 alone across all sectors. By applying the average change unit to the 2014 average cost per watt, Wiser Capital projects the average cost per watt of a 100 kW-350 kW system in the Northeast region to be $3.07 in 2015. This is the cost used in the Massachusetts analysis.

In order to forecast the average utility rate escalation in each state, Wiser Capital used the US Energy Information Administration's Annual Electricity Report datasets, which are published annually. Taking eight years of data from, 2005 – 2013, of average commercial retail blended rates[7] (c/kWh) for each state, Wiser Capital derived the average year-to-year growth rate in utility pricing nationwide and by state. The average utility price in the Northeast in 2015 is 13.38 c/kWh. The Northeast blended rate average is higher than the US average of 11.34 c/kWh, yet the annual pricing escalator in the Northeast is 2.26%, lower than the US average of 3.3%. See the Figure 5 for state specific utility pricing estimates for 2015 and utility pricing escalation factors.

[7] Blended rate definition by the EIA: The retail electricity prices that we publish include all costs for delivered electricity, including generation, transmission & distribution, taxes, fees, etc. They are derived from the revenues and retail sales data we collect from individual utilities in our monthly and annual electric utility industry surveys. The method we use to derive the prices is similar to dividing the dollar amount of your monthly electricity bill (which is the utility's revenue) by the amount of kWh that you were billed for in the month (which is the utility's sales of kWh). We divide the reported utility revenues by type of customer by the volume of sales by type of customer to get an average price by type of customer

Figure 5.

NORTHEAST REGION		
State	Average Utility Price Escalation per Year	2015 Estimated Price
Connecticut	3.41%	15.64
New York	0.98%	15.65
New Jersey	2.56%	13.43
Vermont	3.28%	15.64
Maine	1.45%	12.08
Massachusetts	2.09%	14.83
New Hampshire	1.61%	13.96
Pennsylvania	1.98%	10.28
Rhode Island	1.81%	13.39
Regional Average	**2.13%**	**13.88**

Figure 6.

PROJECTIONS IN NORTHEAST UTILITY PRICING	
Year	**c/kWh**
2014	13.59
2015	13.88
2016	14.18
2017	14.48
2018	14.79
2019	15.10
2020	15.42

A large driver of solar economics in the Northeast region are SRECs and other clean energy incentives specific to each state. Maryland, Massachusetts, New Jersey, and Pennsylvania currently have solar carve outs and SREC markets. Massachusetts is now in its second SREC program under which qualified facilities can generate SRECs for 10 years. While the SREC bid prices vary with supply and demand, the program has a price support mechanism and last opportunity to sell SRECs with the Solar Credit Clearinghouse Auction (SCCA). In years of high SREC supply, buyers are incentivized to purchase SRECs via the SCCA. Currently, the SREC

SCCA is $285/MWh and for a 350kW rooftop project type, the facility would only receive SRECs for 90% of the MWh produced. Considering investment requirements, Wiser Capital's model utilized a significant discount rate to the SCCA for a long-term fixed SREC offtake contract.

Figure 7.

Average Massachusetts Project	
SREC	$285/MWh (SCCA)
Average Cost per Watt	$3.07
Massachusetts Average Utility Retail Price	14.83 c/kWh
Massachusetts Average Utility Price Escalator	2.09%
Wiser's PPA Rate	12 c/kWh
Average System Size	350 kW
Solar Resource Production	1200 kWh/kW/year

Given Massachusetts specific incentives, average cost per watt, retail utility price and utility escalation, average system size, and NASA's regional production assumptions, Wiser Capital derived a PPA rate for an average project in Massachusetts that will satisfy the following:

1) Provide savings to the host facility. In the 350kW system example, savings of $12,170 year one and cumulatively $999,760 over the 25-year period.
2) Meet internal rate of return and other financial requirements by a typical third party mid-scale solar investor.
3) Satisfy a competitive EPC install cost.

Given Massachusetts's lucrative SREC market, Wiser Capital formed a PPA rate of 12 c/kWh, which is below Massachusetts average utility blended commercial rate of 14.83 c/kWh. Wiser Capital also provides a low escalator of 0.25%, as compared to the Massachusetts average price escalation of 2.09%[8]. Assuming Wiser Capital's average project size of 350 kW that covers 80% of electricity use for a customer using 38,500 kWh per month, a savings of $12,166 would be

[8] Average utility escalator was taken from eight years of EIA data using an average of the year to year change over the period.

realized by the host facility in the first year alone. Cumulatively, a commercial entity in Massachusetts could see potential savings of $999,763 over the term of a 25 year PPA. In the graph below (Figure 8), the exponential monetary savings are represented as the area between the average monthly bill under a given utility in Massachusetts and the average monthly bill under Wiser Capital's fixed PPA rate over next 25 years.

Figure 8.

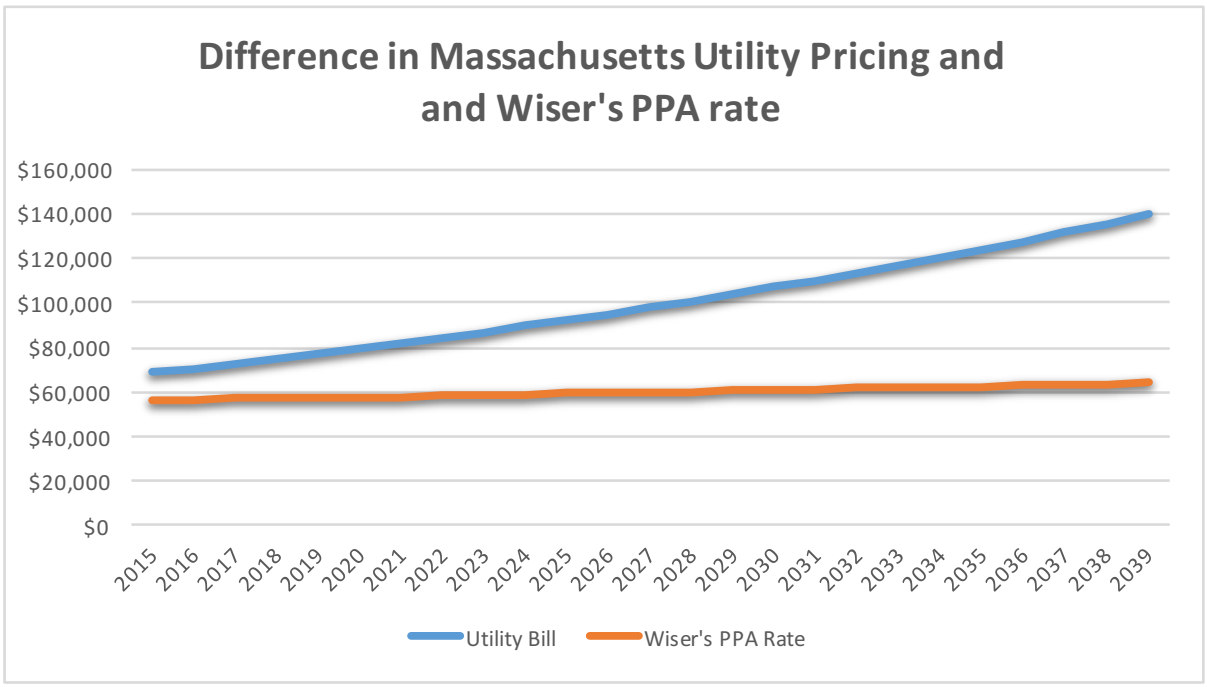


Figure 9. Massachusetts Cash Flow

Year	Current Utility Cost	Utility Cost After Solar	PPA Payments	Total Cost	Savings	**Cumulative Savings**	Estimated Host Facility Buyout Price
2015	$68,515	$10,149	$46,200	$56,349	$12,166	**$12,166**	
2016	$70,570	$10,453	$46,130	$56,583	$13,987	**$26,153**	
2017	$72,687	$10,767	$46,061	$56,827	$15,860	**$42,013**	
2018	$74,868	$11,090	$45,991	$57,081	$17,787	**$59,800**	
2019	$77,114	$11,422	$45,922	$57,344	$19,770	**$79,570**	
2020	$79,427	$11,765	$45,852	$57,617	$21,810	**$101,380**	
2021	$81,810	$12,118	$45,783	$57,901	$23,909	**$125,289**	$415,820
2022	$84,264	$12,481	$45,714	$58,195	$26,069	**$151,358**	$407,037
2023	$86,792	$12,856	$45,645	$58,501	$28,291	**$179,649**	$397,452
2024	$89,396	$13,242	$45,576	$58,818	$30,578	**$210,227**	$386,984
2025	$92,078	$13,639	$45,507	$59,146	$32,932	**$243,159**	$375,545
2026	$94,840	$14,048	$45,438	$59,486	$35,354	**$278,513**	$363,038
2027	$97,685	$14,469	$45,370	$59,839	$37,846	**$316,359**	$349,356
2028	$100,616	$14,904	$45,301	$60,205	$40,411	**$356,771**	$334,381
2029	$103,634	$15,351	$45,233	$60,584	$43,051	**$399,822**	$317,985
2030	$106,744	$15,811	$45,052	$60,863	$45,880	**$445,702**	$300,024
2031	$109,946	$16,286	$44,872	$61,157	$48,789	**$494,490**	$280,467
2032	$113,244	$16,774	$44,692	$61,466	$51,778	**$546,268**	$259,152
2033	$116,642	$17,277	$44,513	$61,791	$54,851	**$601,119**	$235,903
2034	$120,141	$17,796	$44,335	$62,131	$58,010	**$659,129**	$210,526
2035	$123,745	$18,330	$44,158	$62,488	$61,257	**$720,386**	$182,808
2036	$127,457	$18,879	$43,981	$62,861	$64,597	**$784,983**	$152,514
2037	$131,281	$19,446	$43,806	$63,251	$68,030	**$853,013**	$119,384
2038	$135,219	$20,029	$43,630	$63,659	$71,560	**$924,573**	$83,136
2039	$139,276	$20,630	$43,456	$64,086	$75,190	**$999,763**	$43,456

Following a similar procedure, Wiser Capital looked into New York's solar market to construct a feasible PPA rate that benefits the host facility and the investor while staying fair to the system integrator. Unfortunately, an "average" Northeast cost per watt as was utilized in Massachusetts did not make economic sense for the investor, nor for the host facility, due to lower incentives. To determine what a feasible project would look like, Wiser Capital adjusted the installation cost for illustrative purposes.

Although New York does not have an SREC market it does have a performance based incentive. Incentives are differentiated by system size and by two regions - those served by Con Ed and Rest of State (ROS), served by all other utilities in the state. Net metering applicability also factors into the incentive payment for ROS utilities. Statewide, the incentive is designed as a block incentive program that decreases the monetary incentive as the program meets certain capacity requirements. Currently, projects over 200 kW[9] lie within the Commercial and

[9] New York State Energy Research and Development Authority (NYSERDA) defines solar projects as either "Residential and Small Commercial <200kW" or "Commercial and Industrial" >200kW. http://ny-sun.ny.gov/For-Installers/Eligibility-and-Training

Industrial segment currently being paid at Block 1 levels for the entire state.

The ROS incentive is split between a monetary credit for remote net-metering, non-demand facilities, and a volumetric credit for all other facilities. We assumed a sample facility outside a strategic location[10] that qualified for the volumetric credit of 0.114/kWh. The Commercial Industrial Policy Manual outlines that the project incentive may be taken in four increments. The first payment may be applied for when the project is commercially operational and is based on a calculation of 25% of the cumulative three-year production estimates. Three more payments may be requested over the three subsequent years based on 75% of the actual measured annual output (kWh) of the system.

The Con-Ed region offers a more generous incentive of $0.179/kWh, outside strategic locations, with the same 25%/75% distribution. These incentives lie in a block structure that runs on a first-come, first-serve basis. As each block, with a capacity range of 15 MW - 50 MW for the Con-Ed region and 120 MW – 180 MW for the ROS, reaches its limit, a new block will open with a discounted incentive. The monetary incentive decreases by an exponential percentage as a project enters the next highest block. As of paper publication 84% of capacity was remaining in Block 1 for the ROS and 72% in Con Ed. As incentives decrease, cost per watt to install or cost of capital must decrease, or PPA rates must increase to create viable project economics.

Additionally, New York has a higher average utility charge at an estimated 15.65 c/kWh in 2015 and an average escalator of 0.98% according to EIA data. To form a reasonable PPA that made sense for all parties involved, Wiser modeled a 350 kW sample project in New York covering 80% of the electricity use for a the business consuming roughly 43,225 kWh of electricity per month.[11] This analysis takes into account a viable cost per watt, New York's average retail utility price and escalator, utilizing the average system size, NREL's Renewable Resource Data Center's regional production assumption, and the ROS and Con-Ed state incentives.

[10] Strategic Locations are identified by the utility companies where solar will provide added value to the distribution system. These projects qualify for an additional 20% increase in the base incentive. NY-Sun Program Manual

[11] The same size solar array in New York covers a higher electricity use because the solar access, or number of hours of sun per day, is greater in New York than in Massachusetts.

Figure 10. ROS Project Details

Ideal New York Project - ROS	
PBI	$0.114 kWh/3 years
Potential Cost per Watt	$2.62
New York Average Utility Retail Price	15.65 c/kWh
New York Average Utility Price Escalator	0.98%
Wiser's PPA Rate	15.1 c/kWh
Average System Size	350 kW
Solar Resource Production	1235 kWh/kW/year

Installation costs would theoretically need to be $2.62 per watt DC across the Con Ed and ROS regions for a project to make economic sense. Unlike the average cost per watt utilized for Massachusetts that was derived from OpenPV, the cost per watt for New York was reversed engineered, using proprietary software and an understanding of investor requirements, as well as host facility costs. With these data points, a PPA rate of 15.1 c/kWh and an escalator of 0.5% across the ROS region can be offered- saving the business $2,377 in year one. Comparing the long term cost of power between the utility and the PPA, the host experiences significant savings as the cost of power remains relatively flat (0.5% escalation per year), for a cumulative savings of $833,248 by year 25 (Figure 11). This same data is expressed in more detail in the Cash Flow table (Figure 12).[12] Wiser Capital finds that roughly 15% of the commercial company's utility bill after switching to solar will remain paid to the utility company.

[12] Please note that the Utility Cost After Solar column demonstrates the un-offsettable charges of the host facilities utility bill such as demand charges or fixed charges.

Figure 11: ROS Cost of Power Comparison

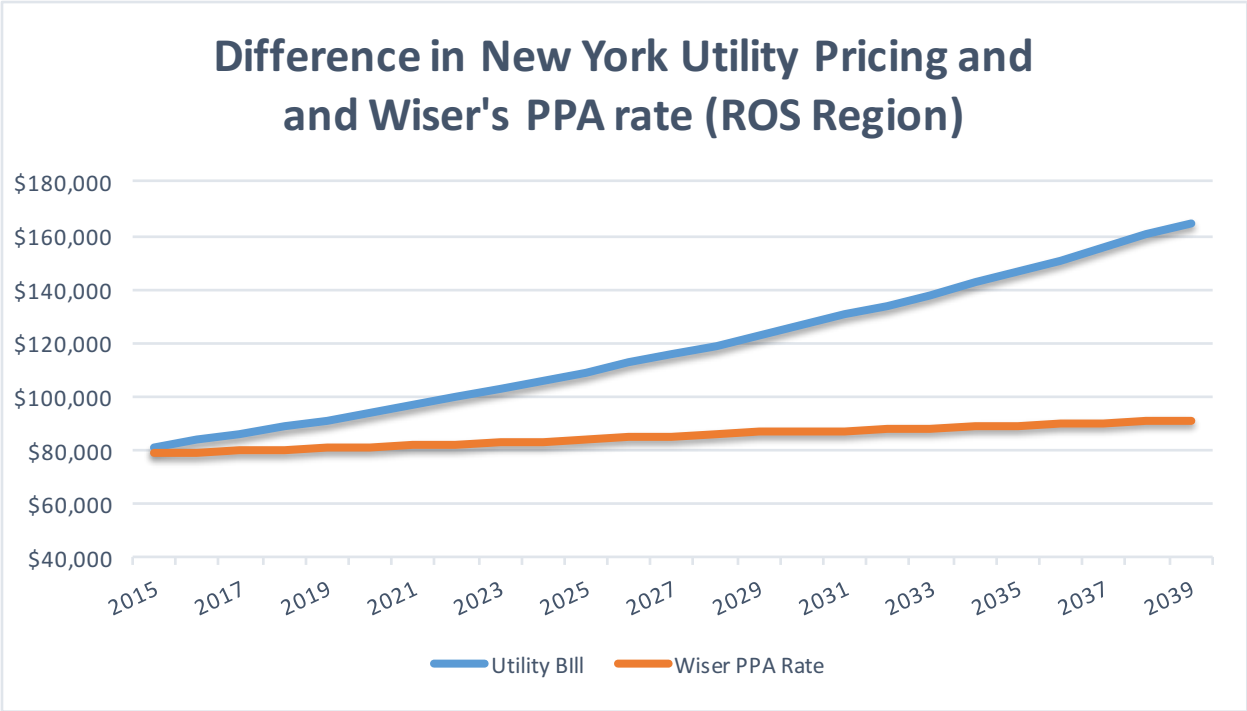


Figure 12. New York Cash Flow (ROS Region)

Year	Current Utility Cost	Utility Cost After Solar	PPA Payments	Total Cost	Savings	**Cumulative Savings**	Estimated Host Facility Buyout Price
2015	$81,177	$13,529	$65,270	$78,799	$2,377	**$2,377**	
2016	$83,612	$13,935	$65,334	$79,269	$4,343	**$6,720**	
2017	$86,120	$14,353	$65,398	$79,751	$6,369	**$13,089**	
2018	$88,704	$14,784	$65,462	$80,246	$8,458	**$21,547**	
2019	$91,365	$15,227	$65,526	$80,753	$10,611	**$32,159**	
2020	$94,106	$15,684	$65,590	$81,275	$12,831	**$44,990**	
2021	$96,929	$16,155	$65,654	$81,809	$15,120	**$60,110**	$603,463
2022	$99,837	$16,639	$65,719	$82,358	$17,479	**$77,588**	$591,583
2023	$102,832	$17,139	$65,783	$82,922	$19,910	**$97,499**	$578,445
2024	$105,917	$17,653	$65,848	$83,501	$22,416	**$119,915**	$563,922
2025	$109,094	$18,182	$65,912	$84,095	$25,000	**$144,915**	$547,877
2026	$112,367	$18,728	$65,977	$84,705	$27,663	**$172,578**	$530,156
2027	$115,738	$19,290	$66,041	$85,331	$30,407	**$202,985**	$510,591
2028	$119,211	$19,868	$66,106	$85,975	$33,236	**$236,221**	$489,000
2029	$122,787	$20,464	$66,171	$86,635	$36,151	**$272,372**	$465,179
2030	$126,470	$21,078	$65,906	$86,985	$39,486	**$311,858**	$438,904
2031	$130,265	$21,711	$65,643	$87,353	$42,911	**$354,769**	$410,293
2032	$134,172	$22,362	$65,380	$87,742	$46,430	**$401,199**	$379,112
2033	$138,198	$23,033	$65,119	$88,152	$50,046	**$451,245**	$345,102
2034	$142,344	$23,724	$64,858	$88,582	$53,762	**$505,007**	$307,978
2035	$146,614	$24,436	$64,599	$89,034	$57,580	**$562,586**	$267,430
2036	$151,012	$25,169	$64,340	$89,509	$61,503	**$624,090**	$223,112
2037	$155,543	$25,924	$64,083	$90,007	$65,536	**$689,626**	$174,647
2038	$160,209	$26,701	$63,827	$90,528	$69,681	**$759,306**	$121,619
2039	$165,015	$27,503	$63,571	$91,074	$73,941	**$833,248**	$63,571

In Con Ed territory, with the same $2.62/watt to install, a PPA rate of 13.5 c/kWh and an escalator of 0.5% that would cumulatively save a commercial entity $9,293 in year one and over $1 million over the 25-year time frame.

Figure 13: Con Ed Project Details

Ideal New York Project– ConEd	
PBI	$0.179 kWh/3 years
Potential Cost per Watt	$2.62
New York Average Utility Retail Price	15.65 c/kWh
New York Average Utility Price Escalator	0.98%
Wiser's PPA Rate	13.5 c/kWh
Average System Size	350 kW
Solar Resource Production	1235 kWh/kW/year

Figure 14: Con Ed Cost of Power Comparison

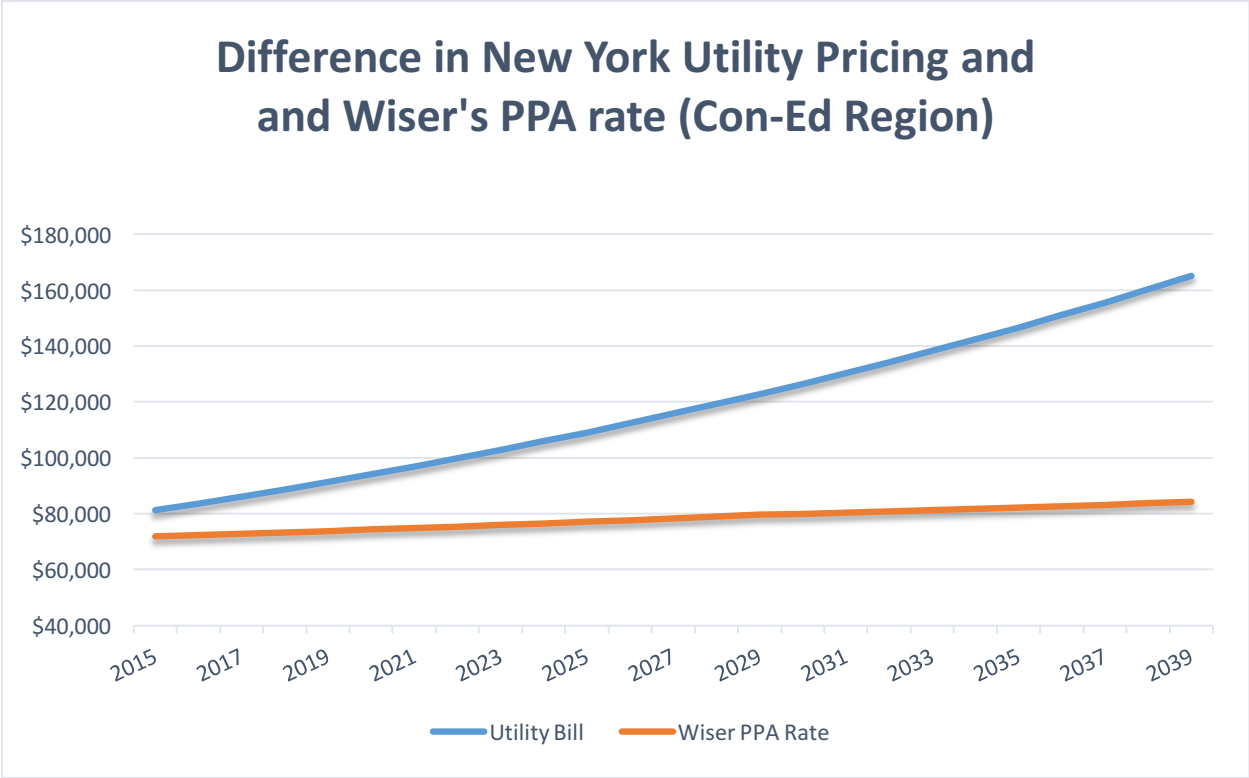


Figure 15. New York Cash Flow (Con-Ed Region)

Year	Current Utility Cost	Utility Cost After Solar	PPA Payments	Total Cost	Savings	**Cumulative Savings**	Estimated Host Facility Buyout Price
2015	$81,177	$13,529	$58,354	$71,883	$9,293	**$9,293**	
2016	$83,612	$13,935	$58,411	$72,346	$11,266	**$20,559**	
2017	$86,120	$14,353	$58,468	$72,822	$13,299	**$33,858**	
2018	$88,704	$14,784	$58,525	$73,309	$15,394	**$49,252**	
2019	$91,365	$15,227	$58,583	$73,810	$17,555	**$66,807**	
2020	$94,106	$15,684	$58,640	$74,325	$19,781	**$86,588**	
2021	$96,929	$16,155	$58,698	$74,853	$22,076	**$108,664**	$539,520
2022	$99,837	$16,639	$58,755	$75,395	$24,442	**$133,107**	$528,899
2023	$102,832	$17,139	$58,813	$75,951	$26,881	**$159,987**	$517,153
2024	$105,917	$17,653	$58,870	$76,523	$29,394	**$189,381**	$504,169
2025	$109,094	$18,182	$58,928	$77,111	$31,984	**$221,365**	$489,823
2026	$112,367	$18,728	$58,986	$77,714	$34,654	**$256,018**	$473,980
2027	$115,738	$19,290	$59,044	$78,333	$37,405	**$293,423**	$456,489
2028	$119,211	$19,868	$59,102	$78,970	$40,241	**$333,664**	$437,186
2029	$122,787	$20,464	$59,159	$79,624	$43,163	**$376,827**	$415,888
2030	$126,470	$21,078	$58,923	$80,001	$46,469	**$423,296**	$392,398
2031	$130,265	$21,711	$58,687	$80,398	$49,867	**$473,162**	$366,819
2032	$134,172	$22,362	$58,452	$80,814	$53,358	**$526,520**	$338,941
2033	$138,198	$23,033	$58,219	$81,252	$56,946	**$583,467**	$308,535
2034	$142,344	$23,724	$57,986	$81,710	$60,634	**$644,100**	$275,345
2035	$146,614	$24,436	$57,754	$82,189	$64,424	**$708,525**	$239,093
2036	$151,012	$25,169	$57,523	$82,691	$68,321	**$776,846**	$199,471
2037	$155,543	$25,924	$57,293	$83,216	$72,326	**$849,172**	$156,141
2038	$160,209	$26,701	$57,064	$83,765	$76,444	**$925,616**	$108,732
2039	$165,015	$27,503	$56,835	$84,338	$80,677	**$1,006,293**	$56,835

While this analysis utilized a blended rate, it is important to note that demand charges will directly affect potential savings. If Wiser Capital cannot offset demand charges or flip the entity's tariff (utility specific) then the estimated savings shown above may be lower. Conversely, a rate flip that takes advantage of a mix of demand and energy charges that better fits with solar production, may result in higher savings.

Another factor calculated into the savings assumptions is that PV systems generally decrease in production at a rate of 0.4% a year. This means that the system will be producing less energy year-over-year and the Host will need to purchase more power from the utility company.

The Total Investments Needed to Pave the Way for the Commercial Solar Boom

Key Findings

The mid-scale third-party financed commercial solar market within the US has lagged behind the residential, large, and utility scale sectors. Wiser Capital, along with industry leaders such as GreenTech Media and Solar Industry Magazine, believe this untapped market is due to a lack of competitive financing that both comprehends the opportunity and is willing to take on the unique underwriting requirements. This trend is changing with risk scoring standardization for unrated facilities, better understanding of solar economics, policies and incentives, and the mainstreaming of solar largely due to the strong residential and large commercial sectors.

In order for investors to be attracted to a region, they need to see a mix of strong returns, ample opportunity, and stable net metering and incentive policies. While California and Hawaii have been the "golden child" of solar, this study proves that the Northeast in general and Massachusetts and New York in particular are highly viable to gain market share and attract investors to the mid-scale commercial space.

New York alone represents a potential investment of $20 billion and Massachusetts would require $11.5 billion to build out all optimal commercial rooftops. Extrapolating findings in these two states to the Northeast Region as a whole, and the potential appetite for solar investments would grow to $67.5 billion.

Methodology

Starting with the number of commercial rooftops that could potentially host a PV solar system, which is explained in detail under "The Untapped Mid-Scale Commercial Solar Market in the Northeast" section, there are 274,637 optimal commercial buildings in the Northeast. This represents the total solar capacity. Recognizing that not all of these projects would qualify for financing, further restrictions were considered. For an investor to commit to a project, they would require that the commercial entity enter in a long-term power purchase agreement and site lease, necessitating they have long-term control over the premises. In addition, investors need to feel confident the commercial entity is financially stable enough to fulfill their commitment to purchase the power for the term of the agreement. Therefore, consideration was given to both control of premises and business failure rates.

Per NREL's April 2015 Report only 52% of businesses operate in buildings with few enough units to offset at least 20% of their demand. Here, we assume that the other 48% of businesses are likely renters or short-term leaseholders that do not have control over their premises, or would not be highly motivated to pursue a PPA since solar would offset less than 20% of their demand. This decreases the total number of buildings to 142,811.

To determine a commercial entity's financial strength, or their likelihood to fulfill the terms of the PPA, general business failure rates were examined. According to the US Bureau of Labor Statistics, within five years approximately 50% of new businesses fail. We assume that we would not finance a business that would be less than five years old, and that with five years of data we could ascertain which businesses would succeed for at least the next two years. Using the same BLS data, 44% of new businesses survive to year seven. This allows us to eliminate another 56% of businesses. Assuming all of the remaining businesses go solar, we are left with 62,837 commercial buildings in the Northeast that are bankable. We realize that not all businesses are new, but this conservative approach gives us a proxy for financial strength.

With an average system size 350 kW, average cost per watt throughout the Northeast region of $3.07[13], and the number of potential rooftops that are solar and investor friendly, Wiser Capital reached a monetary value of total investments within each state and across the Northeast region. It costs roughly $1.07 million to install a 350 kW system on a rooftop. To calculate the total dollar amount required to serve the commercial solar market in the Northeast, Wiser Capital applied the average cost per watt within the Northeast region calculated with Open PV Data.

Using three data points: the average cost per watt, average system size (in watts), and the total number of commercial rooftops that could host solar panels, Wiser Capital calculated the total investments required to seize the untapped mid-scale commercial solar market within New York, Massachusetts, and the Northeast Region presented in Figure 16.

[1313] Please note the full methodology behind the cost per watt calculation can be seen above in the "Monetary Savings the Mid-Scale Commercial Solar Industry Can Bring to the North East Economy" section under *Methodology*.

Figure 16.

State	Total Commercial Rooftops After Reducing for Ownership & Business Viability	Average Cost per Watt givent the Northeast Region	Average System Size (Watts)	Total Investments Required
Connecticut	5,802	$3.07	350,000	6,233,830,016
Maine	2,148	$3.07	350,000	2,307,890,083
Massachusetts	10,739	$3.07	350,000	11,539,450,413
New Hampshire	2,134	$3.07	350,000	2,293,064,512
New Jersey	8,457	$3.07	350,000	9,087,301,085
New York	18,671	$3.07	350,000	20,062,090,647
Pennsylvania	12,177	$3.07	350,000	13,084,274,838
Rhode Island	1,697	$3.07	350,000	1,823,545,147
Vermont	1,012	$3.07	350,000	1,086,907,680
NORTHEAST TOTAL	62,837	$3.07	350,000	67,518,354,421

Given net energy metering caps and transmission constraints, Wiser Capital wanted to ensure this amount of investment would not overwhelm the market. To find the potential solar generation as a fraction of each state's total retail sales, Wiser gathered Total Retail Sales by State data published by the EIA (2013) and projected a 1% increase in retail sales year-over-year to complete a 2015 estimate of total retail sales by state. To find solar production from the given capacity, an average regional solar resource of 1150 kWh/kW/year was utilized to capture potential kWh produced. The result was that solar generation would offset between 8% and 24% of total electricity usage across the Northeast region. State by state figures are detailed in Figure 17.

Figure 17.

State	Estimated Total Commercial Rooftops that Could Host Solar Panels (2015)	Total Commercial Rooftops After Reducing for Ownership & Business Viability	kW Solar Potential	Cumulative kW Already Installed	Total Untapped kW Market	kWh produced	Total Retail Sales (2015)	% Solar Generation vs Total Retail Sales
Connecticut	25,357	5,802	8,874,841	56,278	2,030,564	2,335,148,052	13,270,480,900	18%
Maine	9,388	2,148	3,285,646	3,895	751,756	864,519,086	4,096,721,600	21%
Massachusetts	46,938	10,739	16,428,228	452,809	3,758,779	4,322,595,432	18,069,031,300	24%
New Hampshire	9,327	2,134	3,264,539	4,419	746,927	858,965,534	4,607,791,700	19%
New Jersey	36,963	8,457	12,937,207	614,307	2,960,033	3,404,037,866	38,999,443,100	9%
New York	81,604	18,671	28,561,551	160,726	6,534,883	7,515,115,389	77,877,494,300	10%
Pennsylvania	53,222	12,177	18,627,530	80,315	4,261,979	4,901,275,591	44,011,194,400	11%
Rhode Island	7,417	1,697	2,596,104	3,645	593,989	683,086,944	3,740,706,700	18%
Vermont	4,421	1,012	1,547,385	13,817	354,042	407,147,828	2,057,541,700	20%
NORTHEAST TOTAL	274,637	62,837	96,123,030	1,390,211	21,992,949	25,291,891,721	206,730,405,700	12%

While considerations were made for NEM, the market study and total market cap does not calculate these caps, nor the potential of non-NEM systems for customers with the appropriate load profile and solar plus storage to preclude the issue of NEM aggregate capacity limits.

Conclusion

The mid-scale solar market is ripe for expansion in the Northeast US. A solid mix of available space, potential savings, and investment appetite combine to attract financiers to the market.

Further research into specific utility rate schedules, cost per watt details, and NEM considerations would refine this market and allow financiers and installers to be more focused in their outreach.