DON'T LET THE SUN GO DOWN ON BOSTON

WITHOUT HARNESSING ITS ENERGY USING PHOTOVOLTAIC TECHNOLOGY

City of Boston Environment Department

Mayor's Office of Energy and Environmental Services

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April 25, 2008

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April 25, 2008

To whom it may concern:

As Director of Energy Policy for the City of Boston, Mayor's Office of Environmental and Energy Services, I am writing to commend the work for the City's **Solar Boston** program of four Worcester Polytechnic Institute (WPI) students: Tracy Golinveaux, Christopher Mehr, Justin Wells, and Amanda Young.

All four students demonstrated exemplary skills and work ethic. The students worked closely with Wilson Rickerson, Solar Boston Program Coordinator, who consistently reported his satisfaction with their work. They completed much more work than initially planned for their seven weeks with us. The WPI team selected and assessed ten buildings for future photovoltaic installations and played a key roll in securing grant funds from the Commonwealth of Massachusetts.

Within a remarkably tight deadline, the WPI team created a professional proposal to submit for a $50,000 grant to be applied to solar water heating research, including preliminary profiles for fifteen sites. With the Commonwealth's award, Solar Boston will be able to hire consultants to continue the WPI team's site assessment work in preparation for a bulk procurement and installation of solar water heating units. The WPI team's research—again highly professional in quality—also made possible a successful request from this office for a $500,000 capital budget allocation to install photovoltaics on four municipal facilities.

Without the WPI team's superb assistance, we would not have been able to complete either the $50,000 grant or the $500,000 capital request in time for Mayor Thomas M. Menino's major Solar Boston program announcement with U.S. Secretary of Energy Samuel W. Bodman on April 9 at Fenway Park. With this funding in place, the Mayor was able to announce significant solar programming substance in conjunction with Secretary Bodman's designation of Boston as a Solar America City.

All four of these students—Tracy Golinveaux, Christopher Mehr, Justin Wells, and Amanda Young—have bright futures. Please give them your serious consideration as they translate their excellent education into the workplace.

Sincerely,

Bradford Swing

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ABSTRACT

The ultimate goal of our project was to determine if solar power implementation was feasible in the city of Boston. We used a combination of GIS mapping databases as well as a procedure of roof analysis that had already been established by the City to search for future sites for solar installation. We were sponsored by the City of Boston, which has the funding and capabilities to implement solar power.

We researched, analyzed, and presented our discoveries regarding efficiency and placement of equipment to help guide the new Solar Boston program in its effort to promote sustainable development in the great City of Boston. Based on our analysis, we determined that solar panels are a viable option for the City.

ACKNOWLEDGEMENTS

First and foremost, we would like to thank the City of Boston for sponsoring our project. We would especially like to thank Wilson Rickerson who served as our primary liaison. We wish to extend our thanks to Bradford Swing, Carl Spector, and Jonathan Sinagra who all were very helpful during our project. Also, we would like to thank all of the building managers who allowed us to access the facility roofs and perform our analysis. Finally, we would like to thank our WPI advisors, Professor Vernon-Gerstenfeld and Professor Gerstenfeld. Without the assistance of these individuals, we could not have accomplished as much as we did in seven weeks.

EXECUTIVE SUMMARY

During the past seven weeks we worked with the City of Boston Environment Department and the Mayor's Office of Energy and Environmental Services to determine the feasibility of implementing photovoltaic technologies in Boston, Massachusetts. Despite the opposition to solar implementation in Boston due to the climate of the City and financial issues of installing solar panels, our research and analysis support the use of photovoltaic technology throughout Boston. Our research also demonstrated that the payback period justifies the expenditures involved in installing a solar power system. This paper discusses our findings, analysis, and final recommendations for each specific roof site and the City of Boston as a whole.

Our analysis began by selecting ten city-owned buildings that are good candidates for solar panel installations based on certain criteria. We chose buildings that have large, flat roofs and use a large amount of energy. We also decided to choose buildings in different City departments. From our research on project-based policy, we found that selecting buildings in different departments would allow solar technology to reach more people. We hope that this decision will result in more solar panel installations in each department in the future.

After we selected ten candidates for solar panel installations, we scheduled appointments to visit each site. During the site visit we used a device called a Solar Pathfinder to determine the amount of shaded area on each roof. This device was set up on a site roof and reflected obstructions that would block the sun. We took a digital photograph of the reflections in the device and uploaded it into the Solar Pathfinder Assistant Software. The software calculated the amount of electricity a solar panel array would produce on each rooftop. Finally we used the Massachusetts Technology Collaborative Rebate Estimator to approximate the financial benefits. We requested energy bills from each building we visited in order to complete our financial analysis. Although we did not receive the bills by the time our project had ended, we found valuable contacts that can be used in the future.

We determined an appropriate number of panels, the expected wattage production, the net present value, the simple payback, the installation cost, and the rebate each site would receive. Table 1 shows these values for each specific site:

Table 1: Summary of Findings

Building	Array Size (# Panels)	Array Size (Watts, DC)	Net Present Value	Simple Payback	Installation Cost	Rebate
Brighton High School	500	15572	($2,310)	Year 14	$62,288	$46,718
Central Maintenance	1,000	31,954	($2,803)	Year 14	$101,078	$122,601
Curley Community Center	1,000	35,916	$18,690	Year 13	$107,748	$135,477
Tobin Community Center	579	10,448	($3,207)	Year 18	$115,935	$376,013
Engine 41 Station	170	5,300	($3,587)	Year 19	$15,900	$21,200
Franklin Park Admin Bldg	1,000	2,633	($5,346)	Year >25	$7,899	$10,532
West Roxbury Library	308	2,670	($4,858)	Year >25	$8,010	$10,680
1010 Mass Ave Offices	810	27,478	($13,901)	Year 18	$84,293	$108,054
Strand Theater	401	14,364	$4,875	Year 13	$43,092	$57,456
Maintenance Shops/Garage	696	21,050	($3,829)	Year 17	$63,150	$84,200

Nine out of ten buildings we selected can expect a payback in less than twenty years, while the warranty of a standard solar power system is between twenty-five and thirty years. Of all ten buildings analyzed, only one building would not be suitable for a solar panel installation. We determined this from our rooftop analysis and our financial calculations. Only three of the selected sites would cost over $100,000 to install after the rebate, while two of the three would be producing over thirty thousand watts.

We created many Microsoft Excel spreadsheets and documents that will be submitted to the city. When the funding is available for the purchase of solar panels, the City will have our research and recommendations available.

In conclusion, we recommend that the City of Boston install solar panels on each of the nine selected buildings. It would be beneficial for the city to install solar panel arrays on ten additional buildings to help meet its Solar Boston goals. We also recommend that the City considers purchasing solar technologies from Massachusetts based companies. Purchasing locally will create a larger rebate for the City as well as stimulate the City's economy. Finally, we recommend that the City of Boston maintain the contact list we created during our project in order to expedite future projects.

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CHAPTER ONE: INTRODUCTION

The earth's temperature is currently rising and the changing climate is predicted to have severe consequences that will change the way we live. Collins, Colman, Haywood, and Manning (2007) suggest that one reason for the elevation in global temperature is due to the increase of greenhouse gasses in the atmosphere. Greenhouse gasses are byproducts of the fossil fuels we burn daily to provide heat, electricity, and transportation. As more fossil fuels are burned, more damage is done to our environment.

Grover (2007) agrees that the world's dependence on fossil fuels has led to many problems, including climate change, carbon dioxide emission, smog, soot, and even wars. The more dependent we become on these resources, the more damage we cause to our environment. Grover also notes that most power plants are fueled by burning fossil fuels which produces even larger amounts of carbon dioxide, nitrogen oxide and sulfur dioxide emissions. Those gases contribute to many of the problems associated with global warming.

Fossil fuels are being depleted at an exponential rate. This should appear as more than a warning that it is time to find and utilize alternative energy sources that are both renewable and will not destroy our environment. Alternative energy is a solution to this problem and can be found in natural resources such as wind, geothermal, hydro and solar power.

Solar energy is in great abundance and can easily be converted into electricity or heat. The energy contained in the photons emitted can be harnessed and utilized for our own benefits. The use of solar power is currently being implemented around the world.

An example of a city that is trying to get this transition underway is in South Korea. It has been shown by Kim, Han, and Na (2006) that in the city of Daegu, South Korea the industry involving solar technology has been stimulated by the government. The government is trying to implement solar power by offering incentives and demonstrating its potential. This initiated many solar companies to expand to South Korea and supply the technology in order to meet the demand.

In the United States, there are tax incentives, rebates, and financial aid available in attempt to motivate people to implement solar technology in their homes and businesses. The Solar America Initiative is an example of this type of program. The Solar America Initiative took form in 2007, selecting thirteen cities in America, including Boston, to be a US Department of Energy Solar City Partner. The Solar Boston Program was developed from this initiative. The goal of the program is to lessen the city's dependence fossil fuels and stimulate the growth of alternative fuel technologies ("Solar Boston: Creating a Citywide Solar Strategy Meeting Summary Report," 2007).

The City of Boston Environment Department wants to demonstrate the benefits of solar power to the public in order to encourage them to take advantage of this technology. Currently there are no large scale examples of solar power in Boston. The potential of solar power in Boston is unknown because of the lack of long-term data associated with the technology's implementation within the city. A defined process for investigating and installing solar panel systems has not yet been created in the City of Boston, which is a major problem.

According to Bradford Swing (2008), project-based policy development is the process that the City of Boston uses for developing certain political movements. Because of Boston's strong mayoral figure, the City Council plays a smaller role in terms of policy development. Swing argues that issues that arise on a smaller-scale are good representations of possible barriers that will occur in larger projects of the same theme. Using this argument, he continues with saying that the successful completion of one project will demonstrate whether or not larger-scale projects are feasible. By incorporating topics into the Mayor's agenda, action can be promoted in terms of project development in a given sector. An example of this is the Green Building Policy in Boston; once Mayor Menino started talking about "green" technologies in speeches and conferences, developers began working on research and development of such projects (Swing, 2008).

Ruther, Jose Knob, da Silva Jardim, and Hilario Rebechi (2007) have a similar opinion to Swing's. They believe that if the benefits of this technology are promoted and increased, the economic value of the industry will increase as well. This point was demonstrated to be true in South Korea. Kim et al. (2006) found that manufacturers of solar panels migrated to the country as more of the equipment was in demand. In Daegu, South Korea, the goal of their Green Building Project is to educate the people and to offset some of their energy consumption with renewable energy sources. All public facilities in Daegu will soon need to acquire green technology and the nonpublic structures will need to abide by standards set in the city, which the city government will help offset the costs of. This is very similar to what is being done by the Boston Environment Department, but Daegu is a much larger project.

Another problem associated with solar technologies is getting people to accept the technology and encourage them to use it. There are various opinions on the effectiveness of solar technology. When trying to promote the use of solar technology, Mallet (2005) argues that it is easier to get people to buy into the technology if there is a public-private partnership. He argues that this type of partnership allows both parties to discuss their positions on solar technology which results in a more complete view of the technology. We hope that our complete analysis will allow the City and its residents to see what solar technology is an effective alternative energy for Boston.

Our research encompasses the gap that has been found within the existing knowledge. It is known that the city needs to find alternative sources of energy to power its inhabitants. It is also known that there are funds available to aid in the installation of solar panel units as well as solar water heaters. The overall goal of our project was to solve the problem of finding the best possible sites to implement these technologies in the City of Boston. We accomplished this by collecting and analyzing roof size, energy consumption, and solar irradiation data from possible sites followed by a complete analysis.

We analyzed as many roofs as possible under the time constraints of the project, and we were successfully able to analyze eleven roofs and make recommendations for each. In our final presentation, we made recommendations to the City as to which locations would be best for implementing a photovoltaic project.

CHAPTER TWO: BACKGROUND

GLOBAL WARMING

Feder (2004) relates a fear of changing our dependence from current energy sources in the United States to a potential worldwide environmental catastrophe. Fossil fuels are the most common source of energy in the United States, yet they are also the most common source of air and water pollution, as well as global warming. Collins (2007) argues that with the increase of pollution and greenhouse gases, larger amounts of radiation become trapped in the atmosphere. This has resulted in a dramatic increase of global temperature. Collins also believes that a stable atmosphere is essential for life on this planet mainly because it allows solar radiation to heat the earth's surface. Another characteristic feature of a stable atmosphere is that it prevents some of the radiation from reflecting back into space. This is known as the greenhouse effect.

As the earth's temperature continues to rise, we are finally becoming more aware of the damage we have done to the atmosphere. According to the Union of Concerned Scientists("Massachusetts: Confronting Climate Change in the U.S. Northeast," 2006), the temperature in the Northeast has risen approximately one and a half degrees Fahrenheit in the last forty years and is expected to increase eight degrees in the next hundred years. Snowfall is expected to increase by approximately twenty-five percent in the Northeast. The change in temperature and precipitation may seem small, but it will drastically alter the climate of this region. The sea levels will rise and start to flood coastal areas such as Boston due of the melting polar ice caps. If global warming continues, it is predicted that within the next one hundred years, landmarks such as Faneuil Hall will experience frequent flooding ("Massachusetts: Confronting Climate Change in the U.S. Northeast," 2006).

According to Expert Village (2008) one way to decrease the demand for fossil fuels and energy is to practice conservation of energy. This can be achieved by carpooling, turning off unnecessary lights, and using heat only as needed. These conservative habits reduce the consumption of fossil fuels, which saves money and helps the environment. These practices not only reduce the amount of pollution, but also extend the life of the current oil supply.

ALTERNATIVE ENERGY

Alternative energy can come in many forms. Some examples of alternative energy sources consist of natural resources that are abundant throughout the globe, such as solar power, wind power, and hydropower. Renewable fuels such as ethanol and biodiesel are also available. All of these are currently being recognized in one form or another, but not at a scale large enough for the impact desired.

SOLAR BOSTON

Through programs such as the Solar America Initiative, as we discussed in our introductory chapter, many U.S. cities are researching the advantages of using alternative energy sources. Boston was chosen as one of thirteen American cities to receive financial funding from this initiative. The goal of the initiative is to increase the use of solar power in the United States. The U.S. Department of Energy made nearly $2.5 million available in 2007 to the thirteen cities in attempt to jumpstart the program. The DOE will also provide direct assistance from policy and technical experts to help the cities begin implementation (*DOE to Provide up to $2.5 Million to Implement Solar Energy Technologies*, 2007).

Under the administration of Mayor Thomas M. Menino, the City of Boston has developed many initiatives with respect to climate and energy issues, with the Solar Boston program being one of the most recent. Signed in 2007, Mayor Menino's Executive Order Relative to Climate Change states that the city will decrease its greenhouse gas emissions by eighty percent by the year 2050. This order also contains stipulations regarding recycling, green buildings, and energy efficiency ("Solar Boston: Creating a Citywide Solar Strategy Meeting Summary Report," 2007). The goal of the Solar

Boston program is to implement solar technology throughout the city in order to entice as many people as possible to believe in solar power as a reliable energy source and buy systems for their own homes and businesses. The US Department of Energy (DOE), the Massachusetts Technology Collaborative, National Grid, NSTAR, and many others have contributed to a half million dollar fund to sponsor the program ("The Solar America Initiative. In Focus: The Building Industry," 2007).

Clayton (2004) discusses the City of Boston's solar rebate program, which began on January 23rd, 2008. The $68 million Commonwealth Solar Program will offer rebates from one-third to one-half of the cost for residential implementation or a maximum of one million dollars for commercial implementation**.**

CASE STUDIES DEMONSTRATING THE USE OF SOLAR POWER

Many issues regarding solar power have already been addressed in different countries. These issues include reducing green house gasses, implementing solar power, gaining public acceptance of the technology, assessing feasibility and impact of the technology, and reducing the dependence on fossil fuels.

In Daegu, Kim et al. (2006) discuss the Solar City Daegu 2050 (SCD 2050) Project which began in 2000. Like the Solar Boston Project, South Korea has set near-term and long-term goals to reduce their green house gas emissions. The city of Daegu has set out to accomplish this by promoting renewable energy sources, especially solar panels and solar water heaters. Daegu has found a way, through grants and incentives, to convince its residents that this would help their economy and city. We believe that SCD 2050 can be used as a comparison to Solar Boston because of the relative size of the projects.

Solar investors are concerned with the impact of climate in the Northeastern United States on solar energy collection. If there is not enough sunlight, how can enough solar energy be produced? There have been studies done based on this question to show how different climates and weather patterns affect the solar irradiance of a region. One such study was conducted in Sweden by

Adsten, Perers, and Wackelgard (2002) that investigated the solar irradiation in three Swedish cities. The study found that solar irradiation changed from year to year depending on local weather. A similar study was done by Markou, Kambezidis, Bartozkas, Darula and Kittler (2007) using Athens, Greece and Bratislava, Slovakia, where several years of irradiance data were collected and analyzed to determine if climate had an effect on distribution of luminance effects in the sky. They concluded that gathering solar irradiance data over a number of years would be beneficial to determining future trends in solar irradiance patterns. Although the climates in those countries are not identical to that of Boston, one can see that such studies are beneficial to the decision making process. The data obtained from such studies can be very useful in predicting the amount of energy that can be collected from the sun in a region where the weather and climate are not ideal for solar irradiance absorption.

During our project we visited the George Robert White Environmental Conservation Center in Boston. The building itself is made of many recycled and environmentally friendly materials. It uses green energy such as solar power, solar water heating, and geothermal energy. We were able to witness a facility that has already implemented the technologies and is running smoothly (See Appendix B: George Robert White Environmental Conservation Center for more details).

Another local Massachusetts company, North Coast Seafoods, installed solar panels two years ago. This company is located in Boston's South End in the Marine Industrial Park. The solar panel installation amounted to a $1 million project. Their investment included three hundred panels and two inverters. For this project, the company received half of the installation costs back in terms of rebates from the Massachusetts Technology Collaborative. North Coast Seafoods expects a five-year payback on their investment. After regaining their funds, the company will continue to make a profit on their investment for the remainder of the life of their panels, which will be about twenty years. (See Appendix C for a summary of the interview with the facility manager.)

Just outside of Boston, residents of Natick, Massachusetts installed a small solar panel array on their house. Joanne and Stephen Hallisey have been able to maintain their normal lifestyle while using solar power to supply energy to their home.

The George Robert White Center, North Coast Seafoods, and the Halliseys have all installed solar panels and proved that it is possible to generate solar power in Massachusetts.

COMPARING ENERGY SOURCES

Proposals of solar energy have often found opposition based on the low efficiency of fossil fuels and the high cost of implementing solar power. However, Feder (2004) argues that the typical solar cell has an efficiency of fifteen percent, in comparison to coal, which is the highest at approximately thirty percent, followed by gas at twenty-one percent, and finally oil at a meager nine percent. Even with oil providing such poor efficiency, of the one hundred seven million households nationwide, more than eight million are using oil as a main energy source (EIA, 2007). Gorondi (2008) notes that efficiency is not the only issue when it comes to oil usage, especially in today's market where most people are focused on the cost. Most of the country has ignored solar power as a viable energy source due to the extremely high prices of solar panels and their installation. Recently, oil prices have risen to over $90 a barrel, where one barrel of crude oil contains forty-two gallons (Calder, 2004). Excluding markups from the oil company, which can be up to fifty percent of the cost (EIA, 2007), one gallon of oil would cost approximately $2.14.

One of the main concerns about solar power is the amount of sunlight an area receives. Consumers are often under the impression that states such as California, Florida, Arizona, or Texas would receive the most benefit from the use of solar power due to their climates; however, the Energy Information Administration (2007) research tends to support a different theory. Approximately seventy-eight percent of the oil consumed in the United States is in the Northeastern or Central states. Due to different climates, people in Southern states have different energy demands, resulting in less oil consumption (EIA, 2007).

As oil prices continue to rise, states with less direct sun and colder winters are becoming a viable option for the implementation of solar power. If an average home in the Northeast uses approximately eight hundred gallons of oil at $2.15 per gallon, in one winter the resulting oil bill would be $1,600 (EIA, 2007). Business and home owners now have the option of using alternative energy to help offset the high cost of oil.

In the case study discussed earlier, Joanne and Stephen Hallisey, from Natick, Massachusetts installed solar panels that cost $18,000 (Clayton, 2004). The initial costs of purchasing and installing solar technologies is one reason many consumers do not consider solar power an option; however, Massachusetts is one of many states offering rebates for homeowners ("Massachusetts Technology Collaborative: Commonwealth Solar," 2008) who decide to become environmentally friendly. For the Halliseys, Massachusetts covered half of their cost, so they only paid $9,000 out of their own pockets (Clayton, 2004).

Even with rebates and tax incentives, the cost of installing solar power can result in a large amount of debt. The main issue with most solar power implementations is the initial cost of installation, which is why it is more practical for a larger complex or building to choose solar power since they will have more funds and a larger rooftop space to commit to the project than a local resident. However, many Bostonians have chosen to install solar panels in their homes. Consumers may even decide to invest in solar power even if they do not expect to make a large return, or even any. One reason for this is because some consumers are more focused on helping the environment than making money. Nevertheless, it is possible to analyze the effects of solar power in small settings, and determine how long it will take for the homeowner's investment to pay for itself. Other points of economic interest are returns on investment, cost benefit ratio, and simple payback.

SOLAR TECHNOLOGY: THEN AND NOW

Perlin (2004) discusses ancient Greece and Rome, even as far back as the fifth century BC, where inhabitants utilized the sun as much as possible by facing their houses towards the south. The use of solar power and the sun's energy has been very important to civilizations over the centuries. In modern-day applications, we have technologies that allow us to use the sun's energy in even more ways than just facing our houses towards the sun.

Mills (2004) defines solar thermal electricity as a means of changing collected solar energy into electricity through a conversion process or device using a thermal gradient. Luzzi and Lovegrove (2004) discuss the second law of thermodynamics, which stipulates that the amount of work that can be achieved through the conversion of heat to increase with the increase in the temperature of the heat supplied. Solar cells can therefore convert solar energy into electricity.

Corkish (2004) defines solar cells as a type of device using semiconductor technology. Their main function is to collect photons emitted by the sun that enter into the earth's atmosphere and create an electric current from these particles. Corkish also describes the variety of cell models and processes by which to make these devices. The three main types of solar collectors operate at low- (<110°F), medium- (140-180°F), and high-temperatures (>180°F) (Carlin, 2004). An important form of comparison between instruments is their efficiency and their cost per Watt of output (Corkish, 2004).

Photovoltaic (PV) Cells

Panels.

Photovoltaic (PV) cells generate electricity directly by converting sunlight absorbed from the sun through an electronic process. Certain materials have been found to assist this process naturally, such as silica, and are used in current technology ("Solar Energy Industries Association," 2008). One example of a solar panel is an Evergreen 195W model. We used this solar panel in our analysis (a specification sheet can be found in Appendix F)

Inverters.

An inverter plays a key role in the installation of photovoltaic panels. The purpose of an inverter is to convert the energy collected by the panels in a DC current into an AC current, which is ready for use in the facility. The ratio of inverters to panels depends on the capacity of the inverters, so the number of necessary pieces of equipment varies from project to project.

The Grid.

It is extremely vital for a building in which is implementing solar power to be on the energy grid. The reason for this is so that if the system is producing more energy than what is needed for the building, then the excess power can be sold back to the grid and the building can actually turn a profit. However, a place like North Coast Seafoods uses all of its solar energy and could even use a hundred times more to power its facility.

Solar Water Heaters

Solar water heating devices absorb the sun's rays, similar to the photovoltaic cells. The difference is that they do not convert the energy into an electrical current. The energy absorbed is used to heat the fluid inside pipes that run underneath the surface of the solar water heating unit. There are two types of systems that can be implemented: "open loop" and "closed loop". In open loop systems, the water to be heated flows directly through the solar collection unit. In closed loop systems, an antifreeze solution is fed through the solar collection unit and then through the water heater inside the house. The system that is better suited for heating pools, which was our main focus, is the closed loop system because it is not necessary to heat the water as much as the water used for use inside the house ("Solar Energy Industries Association," 2008).

Choosing Sites for Solar Water Heater Implementation.

When choosing sites to implement solar water heating units, there are some basic criteria that need to be investigated. The first step is establishing the roof layout and the structural layout of the water pipes within the facility. The next step is to establish what the facility is equipped with in terms of heating equipment. The different types of installations will determine whether or not a solar water heating system is viable for the building. The last step is to investigate the heating usage within the facility in order to establish how much energy the system could offset.

SOLAR REBATES

Solar Boston is implementing policies to promote its plan of lowering green house gas emissions. One such policy requires that all newly constructed municipal buildings meet a certain level of standards with regards to energy efficiency in order to promote conservation of resources. There will also be new regulations about where green housing will need to be implemented for new construction projects within the city.

The goal of the Solar Boston Initiative is to make it solar-power cost competitive by 2015 (*DOE to Provide up to $2.5 Million to Implement Solar Energy Technologies*, 2007). In an effort to reach this goal, the Solar Boston program has offered a variety of rebates to consumers willing to implement solar power, with the prices of the panels and installation being the main drawback of solar energy. Rather than filling out grant applications or getting an approval which can often take months or even years, Bostonians who install a solar system will be able to receive mail-in rebates covering anywhere from half to two-thirds of the total cost of installation. In his article published in the Boston Globe, Peter Howe's opinion (Howe, 2007) is that homeowners and businesses could save enough money to pay off their system within five to eight years. There are also a number of tax incentives for consumers who install a solar power system. Some of these rebates and incentives available are summarized in the following section of this document. The City of Boston also provides tips and recommendations for home owners as to how improve their energy efficiency as well as information about different campaigns occurring to promote green technology ("City of Boston: Solar Boston," 2008).

MONEY MATTERS

Although solar technology requires a large initial contribution, there are many factors which make it a much more attractive investment.

Upkeep and Maintenance

Photovoltaic (PV) panels are relatively easy to maintain and are typically able to perform well and beyond their warranties of ten or even twenty years. Maintenance costs are relatively low at approximately one percent of the total system cost ("Photovoltaics," 2008). Since fixed solar panels do not have any moving parts, the only maintenance necessary is general cleaning of the panels themselves ("PA Solar: Maintenance and Durability," 2008).

Solar water heating systems require more attention for maintenance than PV panels. The systems require periodic inspections and more routine maintenance to keep them running efficiently. Solar water heating systems also have more components than PV panels, so often times the components will need to be repaired or replaced over years of use. Most solar water heater maintenance can be performed by the owner; however, some repairs could require a technician. Much like PV panels, solar water heating systems also need to be cleaned for dust, soil, pollen, or other debris as the collectors will perform poorly if covered in debris. A key component in the maintenance of solar water heating systems is the plumbing. Pipes must be checked for cracks and leaks, ducts must be tightly sealed, and wiring properly insulated. All nuts and bolts must also be checked periodically, and depending on the geographic location of the city, freeze protection is a key component to maintaining a system over the years. Using antifreeze and draining the collectors and piping can help increase the life of solar water heating systems (Energy, 2005).

Selling Back to the Grid

Selling back to the grid is another way to save money on solar technologies. Selling back to the grid involves selling Renewable Energy Credits to the electric company. It is possible to make a profit off of solar panels. Jeffrey Gangemi (2006) describes in an article how Carl Baldino invested in solar power for his home in New Jersey in 2006. Baldino is able to collect enough solar energy he needs to supply all of the electricity to his home while having some remaining which he can distribute elsewhere.

Renewable Energy Credits

Again as described by Jeffrey Gangemi (2006), Carl Baldino is able to sell the remaining electricity that is produced by his system in the form of Renewable Energy Credits (RECs). These credits are purchased by electric companies who can distribute the excess electricity throughout the grid. Some electric companies are required to use a certain amount of green energy and can purchase RECs to meet these requirements. Since 2006, Baldino has received $3,000 from the emerging market in RECs.

Long-term Payback

The long-term payback aspect of solar power is important and in the future will be even more relevant according to Kevin DeMarrais (2007). DeMarrais writes that by 2009 there will be fewer rebates offered and people will have to rely on the income received by the energy the sell. Therefore, there will be a higher initial cost, but the long term benefits will remain. Rebates for homeowners and small businesses owners in Boston will be issued until 2012. The goal of the rebate program is to provide a financial model that shows the long-term payback benefits of solar power. Due to increasing rates of renewable energy credits (RECs), the payback received is also likely to increase. In 2007 they were worth approximately $200 and are expected to be worth $600 by next year. The increasing rate of RECs will be the new incentive to invest in solar power when the rebates no longer exist.

POLICIES

Social Acceptance

There have been many dilemmas involved in trying to encourage people to accept the new solar technology. Many times, as Alexandra Mallett (2005) demonstrated in a study, if the general public does not understand how the item works or cannot see a demonstration of its abilities, they are not willing to buy into the idea. Therefore, if the technology can prove itself in an actual situation to have all the benefits it claims to have, the public will be more willing to try it.

Strong Mayoral City and Developing Policies

City governments with a strong mayoral figure are very popular in the United States. This form of city government consists of an executive and legislative branch. In this type of government, the role of the mayor is a strong one. The mayor has all administrative power and the authority to appoint and dismiss department heads without notification to another branch. The mayor also oversees a personal council. The benefit of having a strong mayoral figure is that the mayor has much more freedom and can make decisions without having to involve the city council.

The mayor also dictates the importance of issues within the city and its departments. If the subject is a "hot topic" for the mayor, then the issue is considered "ripe" and will be pursued by researchers; if unimportant, the topic is "unripe". A ripe issue will show up repeatedly at different governmental functions and will be promoted by both the mayor and other officials. This will encourage different departments to become involved. The City of Boston has a strong mayoral influence.

Project-Based Policies

Bradford Swing (2008) discusses the progression of project-based policy development in Boston in his recently published article. Swing argues that policy can be created through the successful completion of projects. This has proven to be an effective development process in Boston. The city's Green building policies were creating using project-based policy. Green building is considered to be a ripe issue in the city and sparked small projects within different city departments. These projects serve as examples for larger, future projects. They identify the barriers and have suggestions for similar projects. With all of the information these small projects provided, public policy for green building was created (Swing, 2008).

The first public demonstration in this direction was with the construction of the George Robert White Environmental Conservation Center in Mattapan. This facility, co-funded by the City of Boston and the Massachusetts Audubon Society, is part of the Boston Nature Center and utilizes multiple types of alternative energy to fuel the electrical and heating demands. We visited the site to learn more about the types of energy they use and to see the place that began the movement towards green building within the City (more can be found in Appendix B). Currently, the Center utilizes geothermal energy, solar water heating, photovoltaic panels, as well as passive solar energy through the placement and size of windows on the facility.

Project-based policy is a major form of policy development by the City of Boston, as explored by Brad Swing (2008). Our project is at the first stage of the development of solar projects in Boston. We are providing the initial development work for a possible new policy on solar energy and photovoltaic technology in Boston. As result we were able to experience project-based policy first hand.

Our Project and the City of Boston

Not only has our project been beneficial to our learning and problem solving skills, but it has also made an important impact on the City of Boston and its steps towards installing solar energy. Working under the coordinator of the Solar Boston program, we were able to directly experience the daily developments the City was making. The findings from our project will not be used immediately, but will be utilized when the time comes to begin installing equipment. Our analysis will be available to supply facility information, personnel to contact, and quantitative numbers that can be used to calculate how much money the City will need for this project. In the future, this project will play a role in the development of future policies in the City for the use of solar and alternative energy technologies.

CHAPTER THREE: METHODOLOGY

FINDING SITES FOR IMPLEMENTATION

A major part of our project involved finding sites for the implementation of solar technology. This required organizing large amounts of data provided by the City.

Geographic Information System (GIS)

GIS was directly applied to our project. Although we did not use the software itself, we analyzed the data the software produced. The City of Boston Environment Department used GIS to organize data from each City-owned building. The data included building size, address, and energy usage per year. We cross-referenced this data in order to determine which roofs would be best for a solar analysis.

Determining Rooftops to Assess

Our liaison, Wilson Rickerson, provided us with many different Microsoft Excel sheets containing the GIS information summarized above. We organized the GIS information into one Excel sheet by relating them to common facilities. Therefore, all of the information for each building could be found in one central document. That Excel sheet allowed us to sort and manage all of the information easily. We determined the largest roofs and which buildings use the most energy. We integrated these lists and picked ten top candidates for solar panel installation after determining if the roof looked relatively flat and unobstructed by surrounding buildings or trees using an aerial photograph of the building from MSN Live Maps. We also determined an additional fifteen candidates for solar water heating installation from this information. We started by researching buildings that had a heated pool or had large water heating demands due to showers or forced steam heating systems. The list of candidates for solar water heating was submitted for review to the Boston Environment Department for use in the future. The list was also submitted to the City for a $50,000 grant for researching these sites further.

COLLECTING ROOF INFORMATION

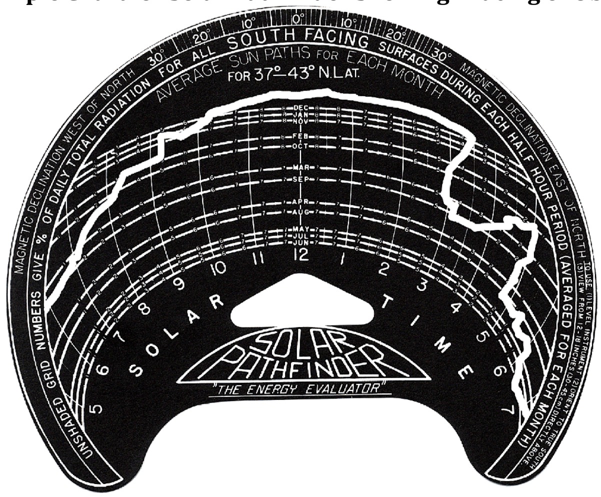
Field research was a major part of our project in Boston. We used various data acquisition tools that enabled us to determine the best possible roof locations to implement solar power, as discussed in the sections below.

Roof Data Collection

Once we had identified the city's top ten candidates for photovoltaic panels using GIS, we began our data collection with the help of John J. Sinagra, the building systems manager. He provided us with a list of city departments and their facility managers' contact information. The facility managers granted us permission to access the roofs. While on the roof, we completed a shading analysis and recorded the roofing material, the size of the roof, and the various structures located on the roof top, including air conditioning units and covered stairwells. We measured the square footage of the roofs using a three hundred foot tape measure in order to get an accurate value for our records.

The Boston Environment Department provided our team with a Solar Pathfinder (see Figure 2 _) in order to perform a shading analysis on each roof (A complete description of the Solar Pathfinder can be found in Appendix D). This device contains a chart covered with a dome that reflects the shadows in the surrounding area down onto the chart as seen in Figure 1 below. The Pathfinder told us how much sunlight was reaching the roof and where shadows were occurring due to obstructions. We mounted the device on a tripod, leveled it, lined the compass up with the magnetic poles, and adjusted the chart according to magnetic declination ("Solar Pathfinder," 2008).

Figure 1: Example Chart for Solar Pathfinder Showing Tracing of Obstructions



("Solar Pathfinder," 2008)

Figure 2: Solar Pathfinder

Using the Solar Pathfinder, it was necessary to collect data only once throughout an entire year at only one point in the day. Therefore we only had to go to each roof once in order to collect a full array of data in order to perform our analysis ("Solar Pathfinder," 2008).

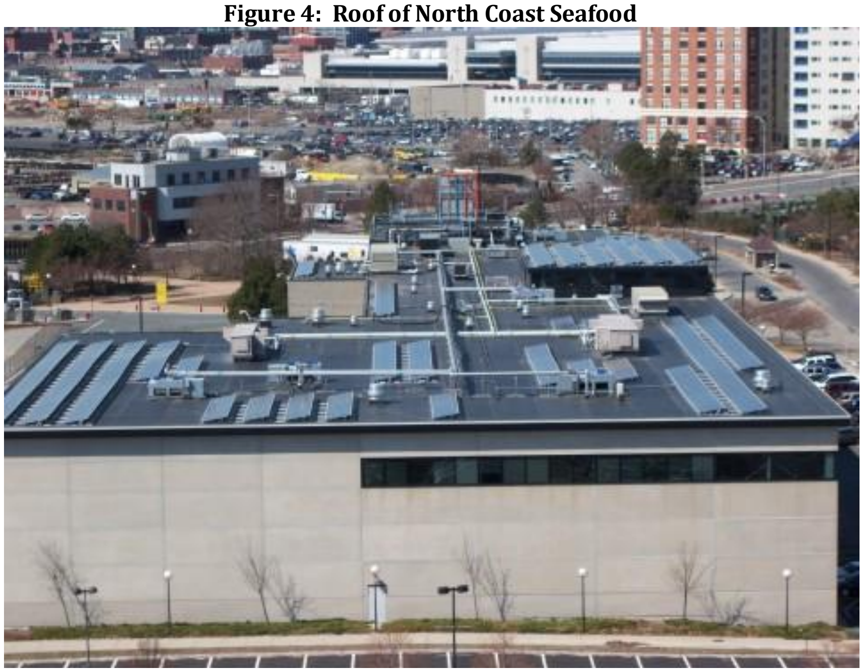
Figure 3: Taking a Reading with the Solar Pathfinder on Top of Boston's City Hall

Solar Usage Research

In order to better understand the impact of solar power in Boston, we gathered data from one facility that has already implemented the technology. We interviewed the Facility Manager at North Coast Seafoods in the Marine Industrial Park located in South Boston. We noticed the company's solar panels (See Figure 4) when we were completing an analysis on top of another building in the Marine Industrial Park. Since the building is within the vicinity of other facilities that we considered, the analysis of their energy production enabled us to determine the impact the installation had on their energy supply.

First, we inquired about how they have implemented solar power and whether it is through solar panels, a solar water heating system, or another form of solar technology. We also asked about the effects of this installation by requesting a history of their electricity bill. We inquired about the cost of implementation, reasons for choosing solar power, and any additional information that they would be willing to disclose about their recent upgrades and steps they are taking towards sustainable development. Using the data from the past year, we were able to analyze their electricity efficiency and gain a greater understanding of the benefits associated with going solar. A summary of the interview can be found in Appendix C.

Figure 4: Roof of North Coast Seafood



Also, we conducted interviews with the nine managers of the ten different department buildings selected by the City for site surveys. During the interviews, we asked for general information needed for our study. Some questions included: What is the square footage of the building? How many floors are there? How much energy is used, in kilowatts, during an average month? Has the company or building manager considered implementing solar power or another alternative energy source? These types of questions also helped us to obtain demographic data for our study so that we were able compare and contrast findings in different establishments. We requested structural plans and the energy usage per month for each of the facilities. This helped us to develop our economic analysis for each site. Those documents will help the City perform a full analysis in the future.

PERFORMING AN ANALYSIS

After data from the Solar Pathfinder had been collected from the rooftops, we uploaded the photographs into the Solar Pathfinder Assistant software (A complete description of the Solar Pathfinder Assistant software can be found in Appendix E). The software analyzed the shadows traced in each picture to determine the percent of the site that was unshaded during the year. This information helped in calculating the annual net capacity factor for each site. The annual net capacity factor is the relationship between the ideal and actual amount of energy generated each year (United States Nuclear Regulatory Commission, 2007).

We used this information in an economic model called the Massachusetts Technology Collaborative rebate estimator ("Massachusetts Technology Collaborative: Commonwealth Solar," 2008). The rebate estimator predicted the cost of the project, the estimated savings from using photovoltaic technologies, as well as the total rebate that could be collected for each site ("Massachusetts Technology Collaborative: Commonwealth Solar," 2008). These calculations told us how well solar energy could be utilized at each location.

RETScreen is another program that is available, but we did not choose to use it. It can be used by the City to perform an in depth analysis of solar water heaters in the future. RETScreen calculated the economic and technical performance of solar panels and solar water heaters before being installed at each site (please see Appendix G for more information on RETScreen). It provided estimates regarding life-cycle costs, emission reductions, risks, and energy production (CETC-Varennes, 2007).

We combined data from interviews with site analysis in order to make recommendations regarding surveyed sites. Once we prepared our final recommendations, we provided our contacts with our recommendations as to what actions should be taken and when they would possibly find a return on their investment. This occurred in a follow-up phone call once we had analyzed the data.

The objectives outlined above provided us with a complete analysis as to whether implementation of solar technology is feasible in Boston. The completion of this analysis resulted in a thorough investigation of the social and economical impact of this renewable energy source.

Calculation and Analysis Tools

Net Capacity Factor.

The net capacity factor determines the ratio of actual power produced at a site as compared to the amount of energy that could potentially be produced at full sun for a duration of time. The equation for this calculation can be found in Appendix J. When investigating net capacity factors for different areas in the country, Massachusetts has an average net capacity factor of approximately twelve or thirteen percent, while in Arizona the average is approximately nineteen percent (Laumer, 2008). The comparable net capacity factors demonstrate that although Massachusetts would not be as efficient in terms of energy production, the differences in climate do not have an overly dramatic impact on the net capacity factor.

Simple Payback.

The Simple Payback calculation determines how long it will take for a facility to make back all of the money they initially spent on their installation. This figure determines whether the investment is worth making. The smaller the simple payback is, the better the investment. In regards to solar panels, if a simple payback is more than twenty-five years, it is not considered a good investment. The equation for this calculation can be found in Appendix J.

Net Present Value.

The net present value of a solar project explains how much a project is currently worth. This includes the initial costs for the project as well as the current amount of money saved from electricity production. The equation for this calculation can be found in Appendix J.

CHALLENGES AND DIFFICULTIES FACED

The early stages of our project were filled with difficulties, due to the organization within the City and communication barriers. Our initial steps required us to organize dozens of excel files, each of which contained information about each city owned building throughout Boston. These files were organized but not in a way that was useful to us. The key components of our project required us to find not only the largest roofs in the city, but also the biggest energy users. The first difficulty we encountered was determining which building belonged to which City department.

Gathering energy data became an unexpected difficulty at the start of our project. John Sinagra played a key role in helping us create our contact list by providing us with names and numbers of property managers for many of the buildings on our list. His efforts were extremely helpful to jumpstart our project.

Contacting the facility managers was another small obstacle we faced during our project. Many of the managers were extremely busy and we were fortunate that they took time out of their schedules to meet with us.

Initially we thought we would have trouble getting permission to access the rooftops. We were pleased to find that the property managers had a real interest in our project and were glad to allow us to perform an analysis of their site.

Once we contacted the property managers, we organized a time and date for a site visit and analysis. Some of the buildings were more than an hour away. There were a few days when one site visit would occupy an entire day of work. Although we were able to split up and go on visits as groups of two rather than as a group, a large amount of our time was spent travelling to and from sites.

One aspect of our project that was less difficult than we expected was using the Solar Pathfinder. The device simply required setting up a four leg stand, leveling the dome on the pathfinder, and making sure it was facing the South. After the device was set up, we took a picture of the dome using a standard digital camera, and easily uploaded them onto the computer, where we performed our analysis.

The largest obstacle we came across was in understanding all of the models and computer software that we used to perform an analysis with the Solar Pathfinder. Along with the provided Solar Pathfinder Assistant software, we learned to use the RETScreen financial model, a MTC Shading Calculator, and a MTC Rebate estimator. Our group had no experience with any of these tools. We were fortunate to have the assistance of our liaisons, who were able to help us understand the inputs and variables that needed to be taken into account when dealing with rebates and investments. Although at first it was extremely confusing to all of us, the knowledge we gained will surely help us in our future endeavors.

Although we encountered many difficulties and set backs, we were able to use our time management and organization skills to complete our project on time and to the best of our abilities.

CHAPTER FOUR: FINDINGS AND ANALYSIS

MOST ATTRACTIVE ROOFTOPS FOR ANALYSIS

When considering solar technologies, it is necessary to first assess the site location to determine if the solar technology is a viable option for energy production.

Photovoltaic Panels

The City of Boston supplied us with data regarding city owned properties. The data included building size, address, energy usage, and department. We compiled all of the data into a large Microsoft Excel sheet which categorized the largest buildings by their city departments. We then saw which buildings had the largest roofs as well as a large electrical load. From that Excel file, we chose ten buildings to implement photovoltaic systems. We decided to include buildings from many different city departments in our top ten list because we felt each department should recognize the importance of alternative energies such as solar panels. The successful completion of the first photovoltaic projects will encourage the departments to install solar panels on more buildings within their department.

After assessing all of this information, we selected the following buildings: Brighton High School (Boston Public Schools), Central Maintenance Facility (Boston Public Works), Curley Community Center (Boston Center for Youth and Families (BCYF)), Tobin Community Center (BCYF), Engine 41 Station (Boston Fire Department), Franklin Park Administration Building (Boston Parks and Recreation), Maintenance Shops (Boston Transportation Department), West Roxbury Library (Boston Public Libraries), Office Building at 1010 Massachusetts Avenue (Property Management and Construction), Strand Theater (Other). We also chose an eleventh building in case we were unable to gain access to any of the previous ten. That facility was the Finland Lab Office Building which is part of the Boston Public Health Commission. A complete profile of each facility in this list can be found in Appendix K.

Solar Water Heating Units

Our analysis was primarily focused on photovoltaic installations, but we also chose fifteen city owned sites to implement solar water heaters to help the City of Boston apply for a $50,000 grant. With the GIS data we discussed earlier, we selected fifteen rooftops for possible solar water heating applications by organizing the buildings by heating loads. Buildings that house heated pools or showers have a large demand for hot water heating and could benefit from solar water heaters. The facilities we selected, listed with their department include: Draper Pool (Boston Center for Youth and Families (BCYF)), Flaherty Pool (BCYF), Mason Pool (BCYF), Curtis Hall Community Center (BCYF), Roslindale Community Center (BCYF), Shelburne Community Center (BCYF), Paris Street Community Center (BCYF), Paris Street Pool (BCYF), Animal Shelter (Boston Animal Control), Brighton High School (Boston Public Schools), Mildred Avenue Middle School (Boston Public Schools), Curley Community Center (BCYF), Police Headquarters (Boston Police Department), Engine 39 Station (Boston Fire Department), Engine 9 Station (Boston Fire Department). More details on the fifteen selected sites can be found in Appendix M.

In order to understand more about solar water heating, we met with Elia Kleiman, a consultant from Synepex Energy, on April 3, 2008 to discuss solar hot water heaters. Elia explained the simple technology behind solar water heaters. They are made up of layers of folded pipes that sit under a large flat black surface. The surface is painted with a special glazing that absorbs heat from the sun. The pipes that run underneath this surface are heated as result and provide hot water.

A more extensive analysis can be done of each on the fifteen buildings we chose, but the time constraints of our project did not allow us to do so. If further analysis is done regarding solar water heaters, Elia recommended gathering data on the roof layout and the heating equipment. He explained that the gas or electric bill for a facility includes all of the heating that the facility uses, not just the hot water heating. He suggested either using July's electric or gas bill or finding thirty percent of the average bill to determine the demand for hot water in a facility. Finally, Elia recommended using RETScreen or Tsol to perform a complete financial analysis.

Since we were not doing a complete analysis, Elia provided us with some rough estimates about the cost of solar hot water heaters. He said that the panels themselves can range from $3,000 to $4,000. Rebates are offered by Keyspan for $8 per therm saved. He estimated that commercially sized solar water heating projects can expect a natural payback in fifteen to twenty-five years.

SOLAR PATHFINDER SITE ANALYSIS AND REBATE INFORMATION FOR PHOTOVOLTAICS

For each site, the Solar Pathfinder Assistant software calculated the percentage of the rooftop area that was unshaded based on the tracing that was done. We estimated that approximately forty percent of each rooftop would be available to install solar panels. This estimate was a rough generalization that we made to account for any structures that could be on the rooftop, such as air conditioning units and stairways. Therefore, we calculated the size of the potential system in terms of square footage and in kilowatts. We put all of this data into an organized Microsoft Excel spreadsheet which can be found in Appendix O. We also contacted NStar to find out if the facility was connected to the electrical grid or not, allowing us to determine if there was an incentive for the facility to sell excess electricity back to the electric company. We did not receive a response during our project; however the City of Boston should expect to receive one soon. Table 2 below shows a summary of our findings for each of the ten selected city owned buildings. Please note that there are empty cells in our tables because we did not have enough time to gather all of the information we had hoped for. The missing information did not allow us to complete a full analysis on each site. We have left these empty cells so the City can fill them in when they decide to complete a more in depth analysis.

Table 2: Summary of Findings

Building	Array Size (# Panels)	Array Size (Watts, DC)	Net Present Value	Simple Payback	Installation Cost	Rebate
Brighton High School	500	15572	($2,310.00)	Year 14	$62,288	$46,718
Central Maintenance	1,000	31,954	($2,803)	Year 14	$101,078	$122,601
Curley Community Center	1,000	35,916	$18,690	Year 13	$107,748	$135,477
Tobin Community Center	579	10,448	($3,207)	Year 18	$115,935	$376,013
Engine 41 Station	170	5,300	($3,587)	Year 19	$15,900	$21,200
Franklin Park Admin Bldg	1,000	2,633	($5,346)	Year >25	$7,899	$10,532
West Roxbury Library	308	2,670	($6,205)	Year 19	$26,280	$35,040
1010 Mass Ave Offices	810	27,478	($13,901)	Year 18	$84,293	$108,054
Strand Theater	401	14,364	$4,875	Year 13	$43,092	$57,456
Maintenance Shops/Garage	696	21,050	($3,829)	Year 17	$63,150	$84,200
TOTAL INSTALLATION SIZE:	**6,464**	**167,385**		**TOTAL:**	**$627,663**	**$997,291**

When we analyzed the data, we assumed that no loans would be taken out to fund the cost of the system. This is because the City has some funds available from the Solar America Initiative and Solar Boston program in order to fund some projects. If loans were taken out, the number could easily be inputted into the models we've provided in Appendix K.

According to our findings, the total cost of all of these installations would amount to be a $627,663 project while the rebate received would be almost $1 million. The total size of the various installations would combine to be a one hundred sixty-seven kilowatt array to promote Boston's solar program.

PHOTOVOLTAIC SITE PROFILES

Brighton High School (Boston Public Schools)

Figure 5: Brighton High School Aerial View

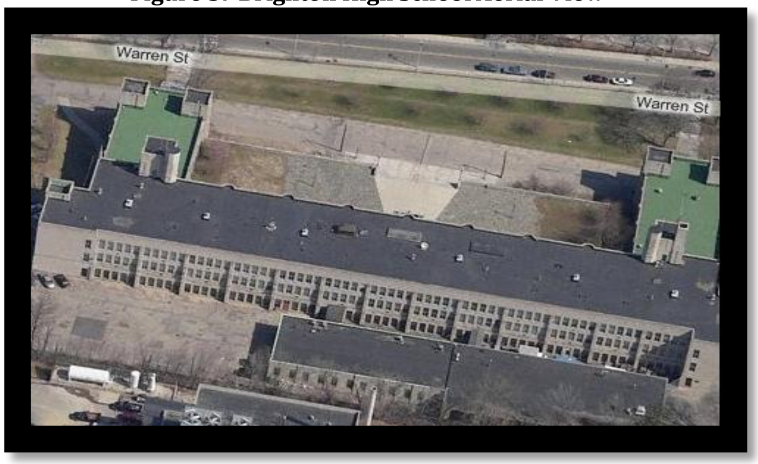


Table 3: Brighton High School PV Data

Area of Rooftop:	216213	sq ft
Percent Unshaded:	96.15%	
Obstructions?:	Skylights	
Suited for SWH?:	Yes	
Electrical Load:		
Heating Load:		
Potential Size of System:	500	panels
Potential Output of System:	31,145	W
Possible Rebate:	$46,718	
Cost of System After Rebate:	$62,288	
On Grid?:		

We found that Brighton High School is an excellent candidate for solar panel installations as well as hot water heater installations. The school has a large flat rooftop which had little obstruction. We analyzed the main roof of the school but noticed additional roof space surrounding the building. These roofs could also be used for a solar panel installation because they are large and flat. The only obstructions on the main roof were skylights and small roof vents. We found that these would not interfere with a solar panel installation. The school has showers in their locker rooms which require a large amount of hot water. Brighton High would therefore be a good candidate for solar water heating. The financial analysis indicated that it would be economically favorable to install solar panels and solar water heaters on Brighton High School. Another added benefit to this installation is that the roof is due to be replaced in the near future. Therefore, the installation of the panels could coincide with the installation of the new roof.

Central Maintenance Facility (Boston Public Works)

Figure 6: Central Maintenance Facility Aerial View

Table 4: Central Maintenance Facility PV Data

Area of Rooftop:	82599.5	
Percent Unshaded:	98.77%	
Obstructions?:	Vents and Pipes	
Suited for SWH?:	No	
Electrical Load:		
Heating Load:		
Potential Size of System:	1000	panels
Potential Output of System:	31,954	W
Possible Rebate:	$122,601	
Cost of System After Rebate:	$101,078	
On Grid?:		

The Central Maintenance Facility proved to be an excellent candidate for solar panel installations. The rooftop was large and flat and had few surrounding obstructions. There were small vents on the roof as well as pipe arrangements. We determined that these would not interfere with a solar panel installation. We did not find this site to be suitable for solar water heaters because it did not have a large hot water heating load. The financial payback proved to be reasonable with a period of only fourteen years. We recommend installing one thousand panels on this roof.

Curley Community Center (Boston Center for Youth and Families)

Figure 7: Curley Community Center Aerial View

Table 5: Curley Community Center PV Data

Area of Rooftop:	73035	
Percent Unshaded:	99.03%	
Obstructions?:	Heating/AV Units	
Suited for SWH?:	Yes	
Electrical Load:		
Heating Load:		
Potential Size of System:	1,000	panels
Potential Output of System:	35,916	W
Possible Rebate:	$135,477	
Cost of System After Rebate:	$107,748	
On Grid?:		

Curley Community Center is one of the best sites for solar water heating and solar panel installations. The roof has a large area and is flat. It also is virtually unobstructed. Since Curley houses a pool and showers, we recommend installing solar water heaters in addition to solar panels. We found that the financial analysis indicated that solar water heaters and solar panels are a feasible investment for the Community Center. We recommend installing one thousand solar panels on this facility. Another added benefit to this installation is that the roof is due to be replaced in the near future. Therefore, the installation of the panels could coincide with the installation of the new roof.

Tobin Community Center (Boston Center for Youth and Families)

Figure 8: Tobin Community Center Aerial View

Table 6: Tobin Community Center PV Data

Area of Rooftop:	23,247	sq ft
Percent Unshaded:	95.19%	
Obstructions?:	No	
Suited for SWH?:	Yes	
Electrical Load:		
Heating Load:		
Potential Size of System:	579	panels
Potential Output of System:	18,045	W
Possible Rebate:	$376,013	
Cost of System After Rebate:	$115,935	
On Grid?:		

We recommend installing five hundred seventy-nine panels on the Tobin Community Center. The building has a large flat roof and has very little surrounding obstructions. There are HVAC systems that take up a small portion of the roof. However, there is still a large amount of space to install panels. We found that this facility could benefit from solar water heaters because it houses a pool and showers.

Engine 41 Station (Boston Fire Department)

Figure 9: Engine 41 Station Aerial View

Table 7: Engine 41 PV Data

Area of Rooftop:	6,852	sq ft
Percent Unshaded:	96.17%	
Obstructions?:	No	
Suited for SWH?:	Yes	
Electrical Load:		
Heating Load:		
Potential Size of System:	170	panels
Potential Output of System:	5,300	W
Possible Rebate:	$21,200	
Cost of System After Rebate:	$15,900	
On Grid?:		

Although Engine 41 is a small site, it is still suitable for solar panel and solar water heating panels. The roof was flat and had very little obstruction. We found that the facility could benefit from having a small solar water heating installation because it has showers for the on-duty fire fighters. We recommend that this facility install one hundred seventy solar panels to provide a portion of their electricity load. This analysis indicates that even a facility with a smaller roof can benefit from solar technology.

Franklin Park Administration Building (Boston Parks and Recreation)

Figure 10: Franklin Park Administration Building Aerial View

Table 8: Franklin Park Administration Building PV Data

Area of Rooftop:	43,514	sq ft
Percent Unshaded:	78.21%	
Obstructions?:	Yes	
Suited for SWH?:	No	
Electrical Load:		
Heating Load:		
Potential Size of System:	1000	panels
Potential Output of System:	2,633	W
Possible Rebate:	$10,532	
Cost of System After Rebate:	$7,899	
On Grid?:		

The Franklin Park Administration Building was the only building we analyzed that was not suitable for solar panel installations. The facility was surrounded by many trees and other obstructions that would block the sun. Also the facility was located near a large hill which would easily allow trespassers and animals to damage the panels. If Franklin Park Administration Building invested in solar panels, the life of the panels would be over before the facility made its investment back because of the poor return on investment. We do not recommend installing solar panels on this building.

Maintenance Shops (Boston Transportation Department)

Figure 11: Maintenance Shops Aerial View

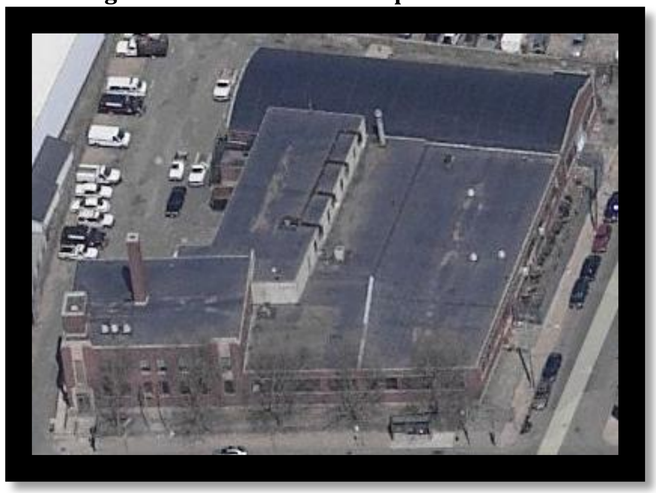


Table 9: Maintenance Shops PV Data

Area of Rooftop:		sq ft
Percent Unshaded:	91.00%	
Obstructions?:	No	
Suited for SWH?:	No	
Electrical Load:		
Heating Load:		
Potential Size of System:	696	panels
Potential Output of System:	21,050	W
Possible Rebate:	$84,200	
Cost of System After Rebate:	$63,150	
On Grid?:		

The Maintenance Shops building is suitable for a solar panel installation of six hundred ninety-six panels. We did not choose this building for solar water heating installations because it does not have a large hot water heating load. The building has a few levels of large flat roof which would be suitable for solar panels. There are very little obstructions surrounding the roof.

West Roxbury Library (Boston Public Libraries)

Figure 12: West Roxbury Library Aerial View

Table 10: West Roxbury Library PV Data

Area of Rooftop:	12,357	sq ft
Percent Unshaded:	86	%
Obstructions?:	No	
Suited for SWH?:	No	
Electrical Load:		
Heating Load:		
Potential Size of System:	308	panels
Potential Output of System (DC):	8760	W
Cost of System:	$26,280	
Possible Rebate:	$35,040	
On Grid?:		

We found that the West Roxbury Library is suitable for the installation of solar panels, although it is not one of our top candidates. We did not consider solar water heating for this building because it does not have a large water heating load. The roof is flat with only few small equipment obstructions. However, there are some trees and other buildings that could obstruct the sun's rays at various points throughout the day and year. Our financial analysis indicated that solar panels are a viable option for this site. We recommend installing three hundred eight solar panels on this facility. The roof will soon be replaced and has the potential to coincide with panel installation.

Office Building at 1010 Massachusetts Avenue (Property Management and Construction)

Figure 13: 1010 Mass Ave Aerial View

Table 11: 1010 Mass Ave PV Data

Area of Rooftop:	32500	sq ft
Percent Unshaded:	91.69%	
Obstructions?:	HVAC	
Suited for SWH?:	No	
Electrical Load:		
Heating Load:		
Potential Size of System:	810	panels
Potential Output of System:	27,478	W
Possible Rebate:	$108,054	
Cost of System After Rebate:	$84,293	
On Grid?:		

The office building at 1010 Mass Ave has two large roof areas. Figure 13 shows the large rooftop covered in gravel as well as the lower black rubber roof. We chose to complete our analysis on the lower roof because it did not have as many obstructions on the upper roof. We recommend that eight hundred ten solar panels are installed on the lower roof at the cost of $84,293. We do not recommend installing solar water heating panels at this site because the building does not have a large hot water heating load.

Strand Theater

Figure 14: Strand Theater Aerial View

Table 12: Strand Theater PV Data

Area of Rooftop:	16085	sq ft
Percent Unshaded:	98.73%	
Obstructions?:	HVAC System	
Suited for SWH?:	No	
Electrical Load:		
Heating Load:		
Potential Size of System:	401	panels
Potential Output of System:	14,364	W
Possible Rebate:	$57,456	
Cost of System After Rebate:	$43,092	
On Grid?:		

The Strand Theater is currently undergoing many renovations. We feel that this site would benefit from a solar panel installation soon so it can be incorporated into their current construction. The site had a large flat roof area that had virtually no obstructions. We recommend installing 401 panels on this roof. We do not recommend installing solar water heaters for this site because they do not have a large hot water heating load.

ECONOMIC VARIATIONS

We examined the effects of changing variables in order to complete a full analysis. We chose a small, medium, and large building to create an alternative analysis for. These buildings are Engine 41, Tobin Community Center, and Brighton High School respectively. Our original results are summarized in Table 13 below for comparison to variations in our analysis located in the following sections.

Table 13: Full Size Array Analysis

Building	Array Size (# Panels)	Array Size (Watts, DC)	Net Present Value	Simple Payback	Installation Cost	Rebate
Engine 41 Station	170	5,300	($3,587)	Year 19	$15,900	$21,200
Tobin Community Center	579	10,448	($3,207)	Year 18	$115,935	$376,013
Brighton High School	1,000	31,145	($4,961)	Year 17	$98,044	$119,971

Reduced Array Size

We reduced the number of panels to half the original amount for each of these buildings. Finally, we conducted a Solar Pathfinder and MTC analysis. Our results are summarized in Table 14 below.

Table 14: Reduced Number of Panels Alternative

Building	Array Size (# Panels)	Array Size (Watts, DC)	Net Present Value	Simple Payback	Installation Cost	Rebate
Engine 41 Station	85	225	($4,239.00)	Year +25	$675	$900
Tobin Community Center	290	2612	($4,003.00)	Year 25	$7,836	$10,448
Brighton High School	500	15572	($2,310.00)	Year 14	$62,288	$46,718

We noticed that the Engine 41 Station, which is a small site, would not benefit from reducing its number of panels. This installation would not be able to pay for itself within the lifespan of the panels. The Tobin Community Center also would not benefit from a reduction of panels because it would cause the simple payback to be increased by seven years. We found that Brighton High School would benefit from reducing the number of panels by half because they would see a larger net present value and also reduce their simple payback by three years. Therefore, we changed our recommendation to include an installation of only five hundred panels at Brighton High School and left the other two buildings the same.

Increased System Cost per Watt

Another alternative analysis included changing the system cost per Watt. Our original analysis included a system cost per Watt of $7. We changed this variable to $10 per Watt for three different sites. We noticed that with a small increase of $3 per Watt the net present value and simple pay back were dramatically decreased. The installation cost and the possible rebate were also increase. The feasibility of solar panels relies heavily on the system cost per Watt. We have included a summary of our financial calculations for the three buildings we chose in Table 15.

Table 15: Varied System Cost for $10/Watt

Building	Array Size (# Panels)	Array Size (Watts, DC)	Net Present Value	Simple Payback	Installation Cost	Rebate
Engine 41 Station	85	225	(56,571)	Year +25	$180,450	$72,180
Tobin Community Center	290	2612	(4,003)	Year 25	$7,836	$10,448
Brighton High School	500	15572	(98,296)	Year 25	$311,450	$119,971

Alternate Rebate per Kilowatt

For each installation, we were interested in seeing how much the rebate from the Massachusetts Technology Collaborative would need to offer in order for the project to have a net present value of or slightly greater than $0. This way, it is possible to see the additional funds that would be necessary to make every project have a positive net present value.

Table 16: Alternate Rebate per Kilowatt

	Rebate Offered by MTC		Altered Rebate		Difference	
SITE	**Rebate/kW**	**Total Rebate**	**Rebate/kW**	**Total Rebate**	**Rebate/kW**	**Additional/ Saved Funds**
Franklin Park	$4.000	$10,532	$6.031	$15,880	$2.031	$5,348
Central Maint.	$3.837	$122,601	$3.925	$125,419	$0.088	$2,818
Strand Theatre	$4.000	$57,456	$3.661	$52,587	($0.339)	($4,869)
Tobin Comm Center	$4.000	$41,792	$4.307	$45,000	$0.307	$3,208
112 Southhampton	$4.000	$84,200	$4.182	$88,031	$0.182	$3,831
1010 Mass Ave	$3.932	$108,054	$4.439	$121,975	$0.507	$13,921
Brighton High	$3.852	$119,971	$4.012	$124,954	$0.160	$4,983
Curley Comm Center	$3.772	$135,477	$3.480	$124,988	($0.292)	($10,489)
Fire Engine 41	$4.000	$21,200	$4.667	$24,788	$0.667	$3,588
West Roxbury	$4.000	$35,040	$4.710	$41,260	$0.710	$6,220
					Total Funds Necessary:	$28,559

According to our analysis, an additional $28,559 would be necessary in order to make every project have a positive net present value.

BOSTON CITY HALL SITE ANALYSIS

We performed an analysis atop Boston's City Hall to demonstrate how we determined if a site was suitable for a solar panel installation. During our roof analysis we noticed many shadows in the solar pathfinder and believed this would not be a good site for solar panels. Figure 15 shows the solar pathfinder image and the numerous obstructions.

After inputting the data in the Solar Pathfinder Assistant Software, we found that the site was seventy-nine percent unshaded. The sun would only be blocked a small portion of each day, meaning that this site would be suitable for solar panels if based only on the Solar Pathfinder analysis. We also had to take into consideration the roof layout. The shape of City Hall's rooftop is not suited for panels because it is not flat and has several levels and a large hole in the middle to allow for the courtyard below. An aerial view of the City Hall rooftop and a tracing of the surrounding obstructions can be seen below in Figure 15.

Although the Solar Pathfinder indicated that City Hall would be a good location for solar panels, our analysis indicated otherwise. We decided that City Hall would not be suitable for solar panels due to its rooftop layout.

Figure 15: City Hall Aerial View & Solar Pathfinder Obstruction Tracing

ADDITIONAL TASKS AND EXPLORATIONS

Although our ultimate goal was to choose ten potential sites for solar panel installation, within the first week of our project the City of Boston required a document containing the five best locations in City as potential solar water heating sites for a proposal of a $50,000 grant. The City requested the $50,000 for technical assistance from the Massachusetts Division of Energy Resources to conduct a full technical and economic feasibility study on solar water heating installation at each location. The five buildings selected were Draper Pool, Flaherty Pool, Mason Pool, Curtis Hall Community Center, and Roslindale Community Center. These buildings were selected for a further analysis, and also contributed to our eventual list of our fifteen sites. With the help of our liaisons, we drafted a proposal with a picture of each location, along with its address and heating usage to create a general profile for each site. A few weeks after submission, we were informed that the Mass Division of Energy Resources granted the City of Boston Solar Boston program the $50,000 requested.

As part of the Solar America Initiative, Boston is one of the thirteen cities selected to receive funds for work on implementing solar technology, as previously mentioned. As far as planning goes, Boston has been recognized as the city that has created the best strategy for organizing the distribution of these funds in the future. A presentation was made to the Mayor and the City of Boston by the Secretary of Energy and a United States Senator at Fenway Park for the great progress the City has made on this effort. Since we are part of the project's development within Boston, we were also invited to attend the event. We were fortunate to witness project based policy first hand.

THIRD PARTY INVESTORS

During our project, we attended a conference call regarding Power Purchase Agreements (PPAs). A PPA is a financial agreement between two investors. For solar power, a PPA is an agreement between a host site and a third party investor. Through a PPA, third parties have the opportunity to invest in solar panels located on someone else's roof. A third party investor would purchase, install, maintain, and own the entire system even though it is located on a host's roof. One advantage to this agreement is that the host sites can purchase the power from the third party investors. The host site also has the opportunity to purchase the solar energy from the third party for a period of ten to twenty years and eventually have the opportunity to purchase the rights to the entire solar panel system.

Since all of the buildings we have considered for solar panel installations in Boston are owned by the City, they are ineligible for tax credits and MTC rebates. Without these rebates, a solar installation might be too expensive. Third party investors are able to take advantage of these rebates and could install the panels for much less than the City. A PPA would allow the third party investors to install panels on City owned rooftops at no cost. The City would then be able to purchase the green power which would count towards its Solar Boston goals. Therefore, we recommend that the City participates in a PPA when installing solar technology.

THE MEANING OF OUR WORK TO THE CITY OF BOSTON

There are many different departments in the City that are working independently of one another to keep the City running. One problem we recognized is that there is a lack of communication among these departments. Before we began our project, the lines of communication that we used to obtain information about each of the buildings had not yet been created. During this project, we went to many different sources in various departments in order to piece together all of the necessary information for each facility. We also had to do this in order to gain access to the rooftops.

We recommend that a solid contact structure would allow the Solar Boston project to rapidly advance. Communication is very important in this field because there are so many different parties involved. In the future when the City installs solar panels, each facility contact will already be familiar with the project so that the installation will be expedited.

ACCOMPLISHMENTS

The team set a list of goals to accomplish during our time in Boston. Our main goal was to solve the problem of finding the best possible sites to implement photovoltaic panels and solar water heating units in the City of Boston by analyzing roof size, energy usage, and solar irradiation data. Our initial goal was to identify the largest roofs owned by the City. After consideration, we revised our list to include the largest rooftops from different departments within the City.

We initially anticipated having to find ten sites for photovoltaic implementation. Due to unforeseen circumstances, we also identified fifteen sites best suited for solar water heating units. We selected these facilities based on large heating loads. We did not visit these sites, but created preliminary profiles for future investigations.

For our final ten sites for photovoltaic arrays, we visited each site and performed a solar shading analysis on each rooftop using the Solar Pathfinder provided by the City. We also requested energy data and structural data, where necessary from each building manager. We performed an economic analysis for each site using tools provided by the Massachusetts Technology Collaborative in order to estimate the benefits each building would receive from implementing solar power. RETScreen International was also used for the few sites that would also possibly benefit from the installation of solar water heaters.

For the majority of the sites, we have not received the electrical and structural data from the facility managers. Although this is the case, we have made contact with each of the managers so that they are aware of the project and our contacts at City Hall.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

While most of resistance to solar power is based around financial concerns, weather becomes an issue when considering implementation in areas of the country with climates of lower solar irradiance. However, we found that solar energy is a suitable option for alternative energy in the New England region. We observed the benefits of a solar installation at both the George Robert White Environmental Conservation Center and at North Coast Seafoods both located in Boston. Although the array installed at North Coast Seafoods did not sufficiently cover their entire electrical demand, it still covers a portion and the company will expect a payback on their investment in five years. We think that other facilities, such as supermarkets, throughout the City would also be able to benefit from using alternative energy sources as well. Supermarkets would be an ideal location due to their high refrigeration demands and freezer loads on their electrical needs, as is the case with North Coast Seafoods.

Our analysis of the ten selected sites included the amount of solar irradiance each rooftop will receive throughout the entire year. This data influenced our decision as to whether or not solar technology would be economically feasible to the City. We found that nine out of our ten selected buildings were good candidates for solar panel installations. We decided to omit the Franklin Park Administration building because we found that the location of the site and the rooftop were not adequate for a solar panel installation.

The investment outcome is dependent on the size of the system and the shading analysis that we completed. Table 17 summarizes our financial findings for each of the ten buildings. In order to perform our calculations, we chose the brand and make of the solar panels for our analysis by recommendation from our liaison, Wilson Rickerson, the Solar Boston Coordinator for the City of Boston. We used Evergreen Solar Spruce Line 195W panels. We chose to use this manufacturer because it is a Massachusetts-based company. This way, money can be kept flowing within the state and can promote local businesses and economy of the state. A product specification sheet can be found of these panels in Appendix F. Below is a table that summarizes our financial findings for each of the ten buildings.

Table 17: Summary of Financial Findings for Final Ten Sites

Building	Array Size (# Panels)	Array Size (Watts, DC)	Net Present Value	Simple Payback	Installation Cost	Rebate
Brighton High School	500	15572	($2,310.00)	Year 14	$62,288	$46,718
Central Maintenance	1,000	31,954	($2,803)	Year 14	$101,078	$122,601
Curley Community Center	1,000	35,916	$18,690	Year 13	$107,748	$135,477
Tobin Community Center	579	10,448	($3,207)	Year 18	$115,935	$376,013
Engine 41 Station	170	5,300	($3,587)	Year 19	$15,900	$21,200
Franklin Park Admin Bldg	1,000	2,633	($5,346)	Year >25	$7,899	$10,532
West Roxbury Library	308	2,670	($6,205)	Year 19	$26,280	$35,040
1010 Mass Ave Offices	810	27,478	($13,901)	Year 18	$84,293	$108,054
Strand Theater	401	14,364	$4,875	Year 13	$43,092	$57,456
Maintenance Shops/Garage	696	21,050	($3,829)	Year 17	$63,150	$84,200
TOTAL INSTALLATION SIZE:	**6,464**	**167,385**		**TOTAL:**	**$627,663**	**$997,291**

RECOMMENDATIONS

Based on our findings, we recommend the following:

1) Solar Panels should be installed in the following buildings:

Table 18: Summary of Installation Recommendations

Building	Array Size (# of Panels)
Brighton High School	500
Central Maintenance	1,000
Curley Community Center	1,000
Tobin Community Center	579
Engine 41 Station	170
West Roxbury Library	308
1010 Mass Ave Offices	810
Strand Theater	401
Maintenance Shops/Garage	696

We recommend that solar panels are installed on these buildings because they prove to be a valid investment. Solar panels will provide a large amount of electricity to the buildings and also help conserve energy.

2) The City of Boston should consider participating in a Power Purchase Agreement (PPA).
3) The City of Boston must consider installing solar technology on additional rooftops in the City to meet its Solar Boston goals and to help lessen the City's dependence on fossil fuels. We recommend installing at least ten additional solar panel arrays on other City owned buildings. This will help the City get closer to the Solar Boston goals and help reduce the City's dependence of fossil fuels.
4) The City of Boston should maintain our contact list for future projects.
5) The City of Boston should consider, when possible, using Massachusetts-based manufacturers and installers of photovoltaic cells, inverters, and solar water heaters. The MTC offers larger rebates per kilowatt to solar panel installations that utilize Massachusetts-based products.

We are providing the initial development work for a possible new policy on solar energy and photovoltaic technology in Boston. As result we were able to experience project-based policy first hand. These recommendations summarize our findings and provide a platform for the City of Boston to reach its Solar Boston goals.

APPENDIX A: CITY OF BOSTON ENVIRONMENT DEPARTMENT

CITY OF BOSTON ENVIRONMENT DEPARTMENT

The City of Boston Environment Department is responsible for overseeing the preservation of the city's natural environment as well as the constructed environment and noise pollution. Essentially, they deal with any and all issues relating to the environment in Boston in order to secure the future livability of the city.

There are several sub-departments that are managed by the Environment Department. These include the Boston Conservation Commission, the Central Artery Environment Oversight, the Historic District Commissions, the City Archaeology Program, the Boston Landmarks Commission, and the Air Pollution Control Commission. Our contact in the Environment Department, Carl Spector, is the executive director of the Air Pollution Control Commission ("City of Boston Environment Department," 2008).

Boston Conservation Commission

The Boston Conservation Commission (BCC) is responsible for overseeing green space and wetlands in Boston. It also controls the Massachusetts Wetland Protection Act (M.G.L c131 s.40), the Massachusetts Rivers Protection Act (HB s. 18.26) and the Conservation Commission Act (HB s. 18.9). The Commission is made up of seven people, all of whom are appointed by the Mayor. Wetlands play an important role in the ecosystem, so the Commission controls many regulations and also delegates project permits ("City of Boston Environment Department," 2008).

Central Artery Environment Oversight

The Central Artery Project's (CA/T) initial role was to have an impact on the environmental issues of residential and business communities in construction efforts. The Joint Construction Management and Coordination Agreement, signed by the City of Boston and Massachusetts Highway Department, gave authority to CA/T to moderate the construction efforts. Some of their responsibilities include issuing permits, reviewing documents, mitigating complaints, and enforcing environmental laws and regulations ("City of Boston Environment Department," 2008).

Historic District Commissions

There are eight local Boston areas that are deemed historic districts that have their own commissions: Aberdeen, Beacon Hill, Back Bay, South End, Bay State Road/Back Bay West, Bay Village, Mission Hill Triangle, and St. Botolph. These commissions regulate the external changes that are proposed for the designated areas. The commissioners are volunteers from the area, from professional organizations, or are designated by the Mayor. Each commission is run differently and creates its own guidelines, while still following the main regulations common to all the commissions as regulated by the Environment Department ("City of Boston Environment Department," 2008).

City Archaeology Program

Created in 1983 as part of the Boston Landmarks Commission, the City Archaeology Department is responsible for protecting Boston's archaeological resources. All of the archaeological remains found on public land in Boston are managed by the department. This branch also offers The City Archeology Program. This program is dedicated to educating the public by providing workshops and tours ("City of Boston Environment Department," 2008).

Boston Landmarks Commission

The Boston Landmarks Commission (BLC) is dedicated to the historic preservation of more than seven thousand properties in local districts of Boston. This sub-department was created under the Boston Environment Department in 1975 to provide assistance in preserving historic properties, to advise demolition activities, and to provide information to the public about preservation practices ("City of Boston Environment Department," 2008).

Air Pollution Control Commission

The Air Pollution Control Commission (APCC) is responsible for the condition of the atmosphere in the city of Boston, which includes several different issues that must be addressed. Air pollution, in general, is one of these concerns. The APCC manages and regulates what types of pollution go into the air, such as dust and exhaust from vehicles and factories. They also deal with current and future parking issues in the Boston area. Another responsibility is to oversee abrasive blasting, which is used to clean buildings and other structures, and allot permits per request. The last area of regulation is of noise pollution which can come from areas such as construction sites and various equipment that is used there. The commission is made up of five members, three of whom are appointed by the Mayor while the other two are included because it is part of their job description and duties. A hearing is held every three months for this commission ("City of Boston Environment Department," 2008).

MAYOR'S OFFICE

The ultimate goal of the Mayor's Office, headed by Boston Mayor Thomas Menino, is to make Boston "a better place to live, work and visit"("City of Boston Mayor's Office," 2008). For his fourth term as Mayor, Menino and his Cabinet came together to create eight goals to address the city's needs, issues of equality, and economic vitality. They plan to focus on the following eight areas: Closing the achievement gap, reducing violent crime, increasing workforce housing, improving city services, creating new jobs, narrowing health disparities, increasing diversity in government, and growing revenue ("City of Boston Mayor's Office," 2008).

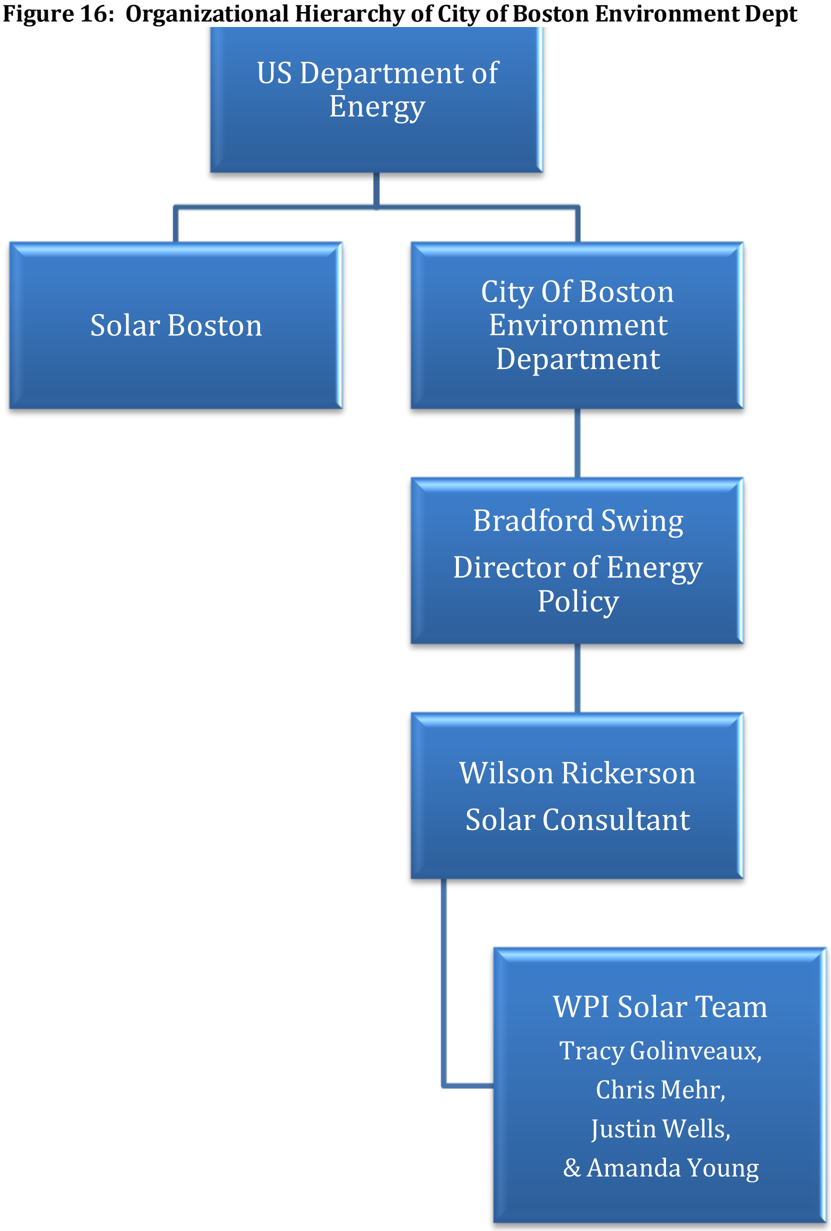
SOLAR BOSTON

In January of 2006, the United States' Government launched the Solar America Initiative. The Solar America Initiative is a program led by the US Department of Energy (DOE) to promote the use and advancement of solar power technologies. The goal of the program is to help lower the cost of solar power so it can compete with other sources of energy by the year 2015. The intention of Solar America is to have enough solar power to provide electricity for one to two million homes in the U.S., avoid ten million metric tons of CO_2 emissions per year, and employ thirty thousand new workers by 2015. Solar America is working with many partners to reach these goals. They have collaborated with the solar industry, national laboratories, universities, federal, state, and city governments, non-governmental agencies, and solar advocacy groups. These groups are focused on researching and accelerating solar power so it can be a market competitor ("City of Boston Environment Department," 2008).

Boston is one of the thirteen cities that Solar America has selected to participate in the adoption of solar energy. The Boston Environment Department is one of the partners working with Solar Boston. Their goals include creating incentive programs and creating a strategy for financing and installing solar technology around the city. These goals reinforce Mayor Thomas M. Menino's Executive Order Relative to Climate Change that was issued in 2007. The order is committed to reducing greenhouse gas emissions by eighty percent by 2050. It also sets goals for recycling, green building, and energy conservation. Wilson Rickerson is the Solar Boston Coordinator and one of our main contacts in the Boston Environment Department. He will be working closely with us to start identifying key areas for solar energy implication, which is one of Solar Boston's goals ("City of Boston Environment Department," 2008).

ORGANIZATIONAL HIERARCHY

Figure 16: Organizational Hierarchy of City of Boston Environment Dept



APPENDIX B: GEORGE ROBERT WHITE ENVIRONMENTAL CONSERVATION CENTER

The George Robert White Environmental Conservation Center (GRWECC) is located in Mattapan, a section of Boston, Massachusetts. This facility is housed by the Boston Nature Center and is co-sponsored by the City of Boston and the Massachusetts Audubon Society through the use of the George Robert White Fund. The purpose of the facility is to demonstrate the product of green building to the surrounding area. Mayor Thomas M. Menino of Boston was quoted saying that the building would act as a teaching unit to the community ("The George Robert White Environmental Conservation Center - Boston's First Green Building," 2008). The grounds of the Boston Nature Center span sixty-seven acres where the Boston State Hospital once stood. An overall view of the outside of the building can be seen below in Figure 17.

Figure 17: George Robert White Environmental Conservation Center

The Center utilizes several types of alternative energy, including geothermal energy as well as solar energy in the forms of photovoltaic panels, solar water heating units, and passively through the placement and size of windows in the facility. They are also looking to implement a wind turbine sometime in the future in order to demonstrate more possibilities for alternative energy that can be utilized in the area.

The site houses two geothermal wells that are drilled down into the earth over one thousand feet to access underground wells. The underground reservoirs can range in temperatures, but hover at approximately 45° Fahrenheit. The heated water is pumped into the facility and, through a heat exchange process, causes the temperature of the air that is used to heat the building to increase. Once the water has been used, it is redeposit in the ground.

Different forms of solar technology are also utilized on the site. Photovoltaic panels are installed on the uppermost rooftop of the facility in the form of roofing shingles, as seen below in Figure 18. There are approximately two hundred shingles that are sized to produce three kilowatts in optimal settings. There are also six stand-alone solar lights on-site, which can be seen in Figure 19. Each light has a battery into which energy is stored during the day so that the light can run after dark.

Figure 18: PV Panels on Uppermost Roof of GRWECC

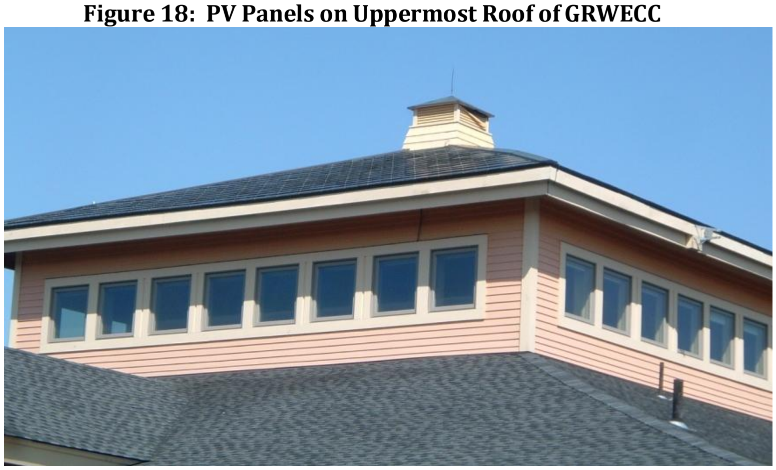


Figure 19: Stand-Alone PV Light at GRWECC

There are also three solar water heating panels installed on the building's roof. These panels account for more than enough hot water that the facility needs for its small kitchen and hot water demands in the bathrooms. The size and placement of the windows in the building is also an important feature in terms of passive solar heating. The windows allow for the light to easily enter, reducing electrical costs as well as drawing in some warmth for the interior air. An example of some of the windows can be seen in Figure 20. A trellis in front of the north-facing buildings also aid in the heating and cooling of the building. The trellis is covered with grape vines that blossom in the summer, blocking some of the sun's rays to keep the interior of the building cooler, while they allow more light through in the winter without its leaves when the vines are dormant.

Figure 20: South-facing and North-facing windows on GRWECC

The goal of the facility is to be able to have everything used during construction to be re-recycled at the end of the building's lifetime. The term re-recycled is used because most of the materials used have already been recycled once. For example, the tiles used in the bathrooms are made from recycled window panes from airplanes and the wooden beams, as seen below in Figure 21, are made from scrap pieces of lumber that would have been normally thrown away. Local materials were also employed in the construction of the facility. The front entrance houses stones that are only found in the Boston Area and are called Roxbury Pudding Stones. These stones were found a local construction site and were transported to the George Robert White Center for use at their facility.

Figure 21: GRWECC Recycled Wood Beam

Not only does the facility use alternative energies, but it also utilizes other technologies to increase its overall efficiency. To reduce the loss of heat, the walls of the facility are tightly insulated with thick polystyrene foam. The facility also houses low-flow toilets to reduce water consumption. The paint used within the facility has lower amounts of volatile organic compounds. Therefore, there are fewer odors that are given off by the paint and this promotes a healthier environment for visitors and employees. Instead of simply dumping their water runoff into the sewers, the landscape is constructed so that water collects and is filtered through the soil before entering a reservoir behind the facility.

APPENDIX C: NORTH COAST SEAFOODS

On April 7, 2008 our group visited North Coast Seafoods to interview Lee Collins, the Purchasing and Facilities Manager. We also completed a shading analysis of the roof. During the interview we learned that the building installed solar panels two years ago. This project was a $1 million investment for the panels and installation; however, they received a rebate of $500,000 from the Massachusetts Technology Collaborative (MTC). With the rebate included, this project has an expected five year pay back. This project is the second largest solar project in Massachusetts and supplies 119,000 kW/year DC. There are three hundred panels on the roof with two DC to AC inverters.

When we asked Lee why North Coast Seafoods chose to go Solar, he told us that the amount of money the MTC "waved in their face" was impossible to turn down. North Coast Seafood uses 1,322,222 kW/year which would require the company to install a hundred more systems like the one they are currently using, so even with the great rebates MTC is offering, it would cost North Coast Seafood $50 million to power their entire electric load on solar panels alone. However, the system does provide nine percent of North Coast Seafoods' electrical load.

The fact that solar panels provide a portion of the company's electric load and that North Coast Seafoods can continue selling their renewable energy credits still makes solar an attractive investment. They should receive their investment money back within five years, and will continue to make a profit for more than twenty years after that.

ROOFTOP ANALYSIS

Figure 22: North Coast Seafoods Pathfinder Report

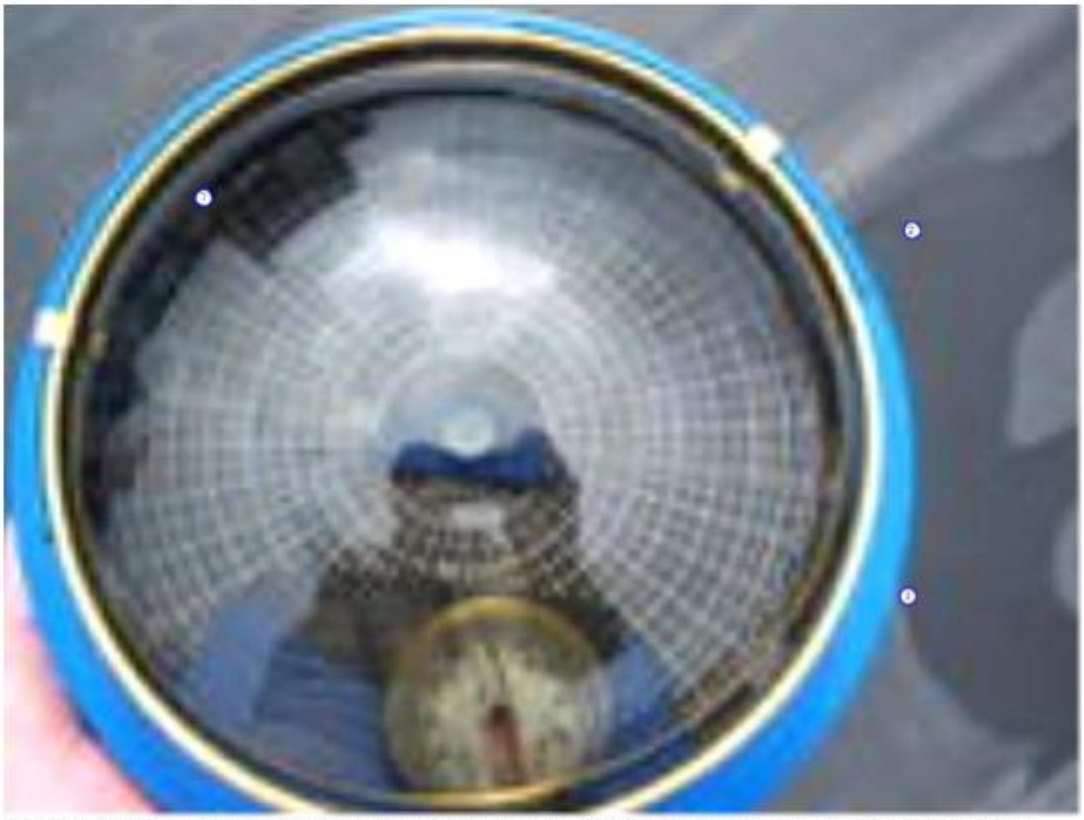
WPI Solar Team and Solar Boston Site Report

Report Name	North Coast Seafood
Report Date	4/14/2008 2:09:39 PM
Declination	-15d 13m
Location	BOSTON, MA, Zipcode: 02210
Lat/Long	42.348 / -71.041
Weather Station	Boston, MA, Elevation: 6 m
Site distance	1.34 miles
Array Type	Fixed
Tilt Angle	42.35 deg
Ideal Tilt Angle	43.00 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Make	Evergreen Solar
Panel Model	ES-195-RL
Panel Count	300
DC Rate (per panel)	195.00 W
Inverter Count	2
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	Custom
Layout Point Count	3

Notes: Have installed 300 panels with 2 inverters
Pay Back is in five years with 50% rebate
Report generated by SolarPathfinder Assistant Version 3.0.7.0. http://www.solarpathfinder.com
Page: 1/6

WPI Solar Team and Solar Boston System Picture Layout

Layout Type Custom
Layout Point Count 3



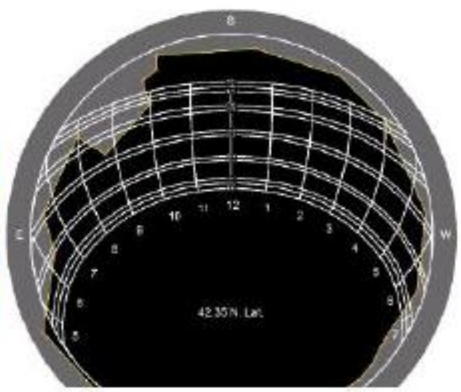
Report generated by SolarPathfinder Assistant Version 3.0.7.0. http://www.solarpathfinder.com
Page: 2/6

WPI Solar Team and Solar E1st
Solar Site Analysis Report

Image File th_northcoast1.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	87.00%	2.18	3726.00	3346.74
February	87.00%	2.89	4397.00	3870.49
March	99.00%	4.17	6127.00	6116.89
April	99.00%	4.46	6093.00	6064.98
May	100.00%	5.10	6953.00	6952.41
June	100.00%	5.70	7277.00	7275.65
July	100.00%	5.36	7012.00	7011.24
August	99.00%	5.00	6672.00	6640.81
September	99.00%	5.09	6771.00	6724.40
October	87.00%	3.37	5325.00	4676.82
November	77.00%	2.13	3816.00	3005.74
December	84.00%	1.96	3494.00	2969.23
Totals	**93.24%**	**47.41**	**67663.0**	**64655.41**
	Unweighted Yearly Avg	**Effect: 95.14% Sun Hrs: 3.95**		
Notes:	[None]			



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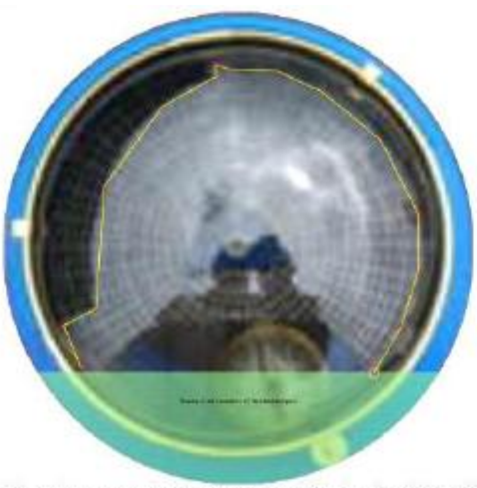
WPI Solar Team and Solar Boston
Solar Site Analysis Report

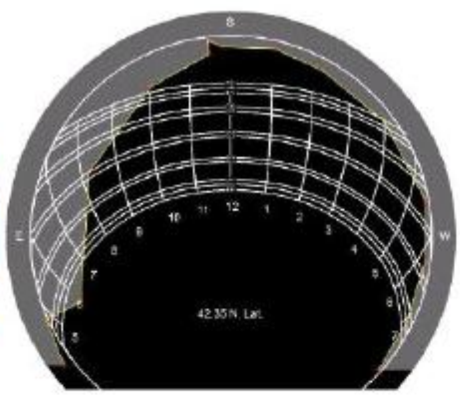
Image File th_northcoast2.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	89.00%	2.21	3726.00	3395.46
February	90.00%	2.97	4397.00	3995.80
March	93.00%	3.91	6127.00	5755.13
April	94.00%	4.24	6093.00	5771.82
May	94.00%	4.81	6953.00	6618.21
June	96.00%	5.50	7277.00	7053.83
July	97.00%	5.18	7012.00	6816.20
August	93.00%	4.72	6672.00	6283.03
September	91.00%	4.70	6771.00	6215.27
October	87.00%	3.36	5325.00	4654.51
November	82.00%	2.25	3816.00	3167.42
December	84.00%	1.96	3494.00	2969.23
Totals	**90.80%**	**45.80**	**67663.0**	**62695.91**
	Unweighted Yearly Avg	**Effect: 91.91% Sun Hrs: 3.82**		

Notes: [None]





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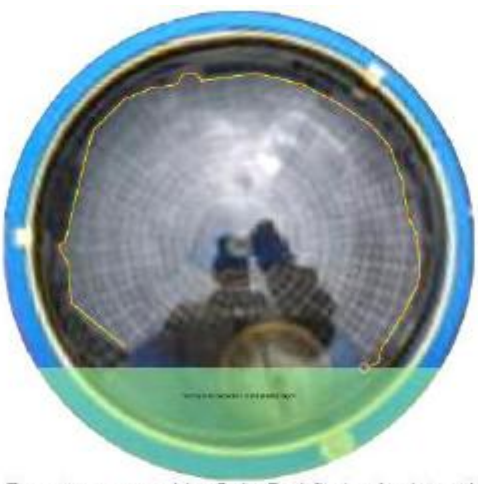
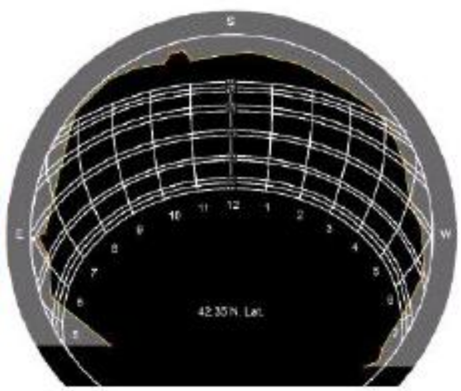
WPI Solar Team and Solar E 3 st
Solar Site Analysis Report

Image File th_northcoast3.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	98.00%	2.45	3726.00	3714.70
February	97.00%	3.23	4397.00	4324.93
March	99.00%	4.14	6127.00	6108.25
April	100.00%	4.48	6093.00	6082.49
May	100.00%	5.08	6953.00	6949.61
June	100.00%	5.68	7277.00	7270.57
July	100.00%	5.35	7012.00	7009.67
August	100.00%	5.04	6672.00	6672.00
September	98.00%	5.06	6771.00	6705.67
October	97.00%	3.76	5325.00	5227.81
November	97.00%	2.68	3816.00	3771.79
December	98.00%	2.30	3494.00	3467.58
Totals	**98.66%**	**49.26**	**67663.0**	**67305.08**
	Unweighted Yearly Avg	**Effect: 98.84% Sun Hrs: 4.10**		

Notes: [None]

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WPI Solar Team and Solar Bost Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	91.33%	2.28	3726.00	3485.63
February	91.33%	3.03	4397.00	4063.74
March	97.00%	4.07	6127.00	5993.42
April	97.67%	4.39	6093.00	5973.10
May	98.00%	5.00	6953.00	6840.08
June	98.67%	5.63	7277.00	7200.02
July	99.00%	5.30	7012.00	6945.70
August	97.33%	4.92	6672.00	6531.95
September	96.00%	4.95	6771.00	6548.45
October	90.33%	3.50	5325.00	4853.05
November	85.33%	2.35	3816.00	3314.98
December	88.67%	2.07	3494.00	3135.35
Totals	**94.22%**	**47.41**	**67663.0**	**64885.46**
	Unweighted	**Effect: 95.30%**		
	Yearly Avg	**Sun Hrs: 3.96**		

Notes: Have installed 300 panels with 2 inverters
Pay Back is in five years with 50% rebate
Report generated by SolarPathfinder Assistant Version 3.0.7.0. http://www.solarpathfinder.com
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APPENDIX D: SOLAR PATHFINDER

OVERVIEW OF CAPABILITIES

The Solar Pathfinder is a tool that utilizes a 360 degree view to assess the solar radiance received in an area for an entire year with just one reading. This equipment is non-electronic and does not require any special technical skills to operate. This type of equipment has been in existence for approximately thirty years and when compounded with archived irradiance data, can provide an accurate representation of an area in terms of the radiance it receives from the sun on an hourly, daily, and annual basis ("Solar Pathfinder," 2008).

HOW TO COLLECT DATA

The equipment is set up on a relatively level tripod. The stage with the chart is rotated so that the compass points to magnetic north. Due to magnetic fields and depending on position, the chart is rotated so that it points directly south as well. This equipment is based on the principle of reflection and will display the shadows on the chart for collection. Therefore, there is a high-polished dome that reflects the images of structures surrounding an area down onto the graphing surface. This is placed above over the charts once aligned. The outlines of the shadows are then traced on the graph below for a specific area.

Graphs are made depending on the latitude position from which you are measuring data. This is because at the equator, the sun's rays are most direct. The angle at which the sun shines on a location increases when moving further away from the equator. Therefore, the charts will need to change depending on how the sun is shining on the area that you are measuring data for ("Solar Pathfinder," 2008).

ANALYZING THE DATA

Once the outlines of the shadows are drawn, the average radiance data for an area can be calculated based on the chart it was drawn on. This can be done based on the lines that make up the chart. The vertical lines indicate the time of day in half hour intervals. The horizontal lines indicate months of the year. The combination of these two types of readings will indicate how the radiance values for the area will change depending on the time of the year.

Using the Solar Pathfinder Assistant software, more data can be extracted for the selected site. By taking a picture of the Solar Pathfinder at the site of interest with a digital camera, the outlines of the shadows can be traced using a computer program and by entering the zip code of the site being analyzed, a full analysis can be generated. A report is then electronically created based on this data ("Solar Pathfinder," 2008).

BENEFITS OF THIS EQUIPMENT

Using this equipment, only one reading needs to be taken at a site to develop a full comprehension of what occurs in an area for an entire year. Using the Solar Pathfinder Assistant software, a more accurate depiction of the data can be obtained. Therefore, a more accurate report of annual data can be analyzed using the software.

APPENDIX E: SOLAR PATHFINDER ASSISTANT SOFTWARE

The Solar Pathfinder Assistant Software is an easy to use program that involves few inputs and produces complete reports on specified sites for photovoltaic or solar water heating installation. Starting a report requires inputting the angle of the panels, number of panels, zip code of the location, type of inverter and rate, the number of inverters, and a picture taken of the dome of the pathfinder. A few of the inputs are predetermined or can be set to a default, which is standard for most solar analysis. On each roof, four or five Solar Pathfinder pictures are taken, generally one in each corner of the roof. The pictures show reflections of obstructions in the area which would prevent sunlight from hitting the roof. These pictures are uploaded into the Solar Pathfinder Assistant Software. Once uploaded, a tracing is done of the reflected obstructions and the software performs calculations. The software creates a final report which consists of a shading analysis for each month and an average percent of un-shaded area for the site. These numbers provide information necessary for calculating rebates in the Massachusetts Technology Collaboration rebate estimator.

APPENDIX F: EVERGREEN SOLAR PANEL SPECIFICATION SHEET

Using the Solar Pathfinder Assistant Software, it is possible to choose known makes and models of panels as part of the analysis. Therefore, for each of our sites, we chose a preliminary panel that could be utilized. Evergreen Solar is a Massachusetts-based company that produces many different solar panels. We chose the 195 watt panel of the Spruce Line for this industrial application, although any panel could be used. The difference between the panels is the DC rating under which each is categorized.

Figure 23: Evergreen Solar Panel Specification Sheet

evergreensolar
Think Beyond.

SPRUCE LINE™
photovoltaic modules

New 195W module

- Highest power and efficiency yet
- Best available tolerance -0 / +2.5%

A range of high quality poly-crystalline solar panels for on-grid markets offering exceptional performance, extraordinary versatility and industry-leading environmental credentials based on our cutting-edge String Ribbon™ wafer technology.

- Best-in-class performance ratings proven by field installations
- 98% of rated power guaranteed for 180, 190W product; 100% guaranteed for 195W product
- 5 year workmanship and 25 year power warranty for ultimate peace of mind*
- More installation versatility with our extensive range of mounting options
- Higher strength with wind and snow loads guaranteed up to 80 lbs/ft²
- Qualified to all major industry certifications and regulatory standards
- Smallest carbon foot-print leading the fight against global warming
- Quickest energy payback time for the maximum energy conservation
- Cardboard-free packaging for minimal on-site waste and disposal cost

*For full details see the **Evergreen Solar Limited Warranty** available on request or online.
This product is qualified to UL 1703, UL Fire Safety Class C, IEC 61215 Ed.2, TÜV Safety Class 2 and CE
String Ribbon and Spruce Line are trademarks of Evergreen Solar Inc. String Ribbon is also a patented technology of Evergreen Solar Inc.

evergreensolar

Electrical Characteristics

Standard Test Conditions (STC)[1]

		ES-180 RL, SL, TL or VL*	ES-190 RL, SL, TL or VL*	ES-195 RL, SL, TL or VL*
P_{mp}[2]	(W)	180	190	195
$P_{tolerance}$	(%)	-2%	-2%	-0%
$P_{mp, max}$	(W)	186.1	194.9	199.9
$P_{mp, min}$	(W)	176.4	186.2	195.0
P_{ptc}[3]	(W)	159.7	168.8	173.3
V_{mp}	(V)	25.9	26.7	27.1
I_{mp}	(A)	6.95	7.12	7.20
V_{oc}	(V)	32.6	32.8	32.9
I_{sc}	(A)	7.78	8.05	8.15

Nominal Operating Cell Temperature Conditions (NOCT)[4]

P_{mp}	(W)	129.0	136.7	140.1
V_{mp}	(V)	23.3	23.8	23.9
I_{mp}	(A)	5.53	5.75	5.86
V_{oc}	(V)	29.8	30.3	30.5
I_{sc}	(A)	6.20	6.46	6.59
T_{NOCT}	(°C)	45.9	45.9	45.9

[1] 1000 W/m², 25°C cell temperature, AM 1.5 spectrum;
[2] Maximum power point or rated power
[3] At PV-USA Test Conditions: 1000 W/m², 20°C ambient temperature, 1 m/s wind speed
[4] 800 W/m², 20°C ambient temperature, 1m/s wind speed, AM 1.5 spectrum
* RL model made in Germany without cell texturing; SL model made in USA without cell texturing; TL model made in Germany with cell texturing; VL model made in USA with cell texturing

Low Irradiance

The typical relative reduction of module efficiency at an irradiance of 200W/m² in relation to 1000W/m² both at 25°C cell temperature and spectrum AM 1.5 is 0%.

Temperature Coefficients

α P_{mp}	(%/ °C)	-0.49
α V_{mp}	(%/ °C)	-0.47
α I_{mp}	(%/ °C)	-0.02
α V_{oc}	(%/ °C)	-0.34
α I_{sc}	(%/ °C)	0.06

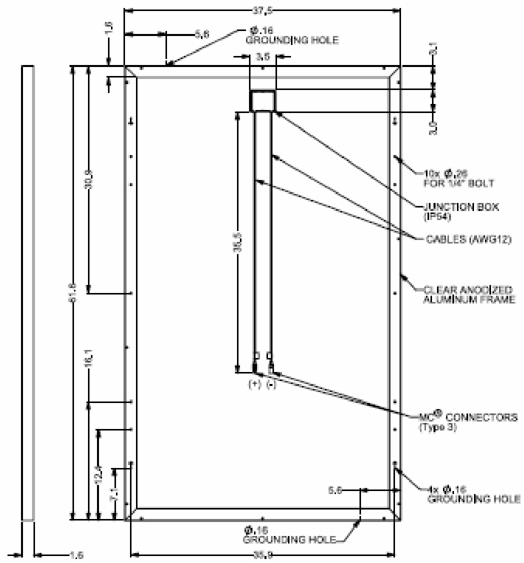
System Design

Series Fuse Rating[5]	15 A
UL Rated System Voltage	600 V

[5] Also known as Maximum Reverse Current

ELECTRICAL EQUIPMENT
CHECK WITH YOUR INSTALLER

Mechanical Specifications



All dimensions in inches; module weight 40.1 lbs

Product constructed with 108 poly-crystalline silicon solar cells, anti-reflective tempered solar glass, EVA encapsulant, Tedlar® back-skin and a double-walled anodized aluminum frame. Product packaging tested to International Safe Transit Association (ISTA) Standard 2B. All specifications in this product information sheet conform to EN50380. See the **Evergreen Solar Safety, Installation and Operation Manual** and **Mounting Design Guide** for further information on approved installation and use of this product.
Due to continuous innovation, research and product improvement, the specifications in this product information sheet are subject to change without notice. No rights can be derived from this product information sheet and Evergreen Solar assumes no liability whatsoever connected to or resulting from the use of any information contained herein.

Partner:

S195_US_010707; effective July 1st 2007

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("Evergreen Solar: 195W Model Specification Sheet," 2008)

APPENDIX G: RETSCREEN INTERNATIONAL ANALYSIS SOFTWARE

We used the RETScreen International Clean Energy Project Analysis Software for the sites that qualified for possible installation of solar water heating units. This software is free and is provided by a Canadian company. It was developed because the company wanted to install a solar wall that would be used for heating the building and they did not know the economic benefits associated with such an installation. They then developed other analyses for several types of renewable energy technologies and translated it into several languages. The software also has access to climate data by region as provided by NASA.

The RETScreen International software is a five-step software that can be used to develop a full analysis on the system in both economic terms and fuel efficiency terms. The five steps in the standard analysis are the energy model, the cost analysis, the emission analysis, the financial analysis, and the sensitivity and risk analysis. These steps offer an overall picture of what each sites benefits and drawbacks are. The energy model calculates how large the system is and how much energy can be utilized by the system. The cost analysis calculates how much the system will cost and what the monetary returns on the system will be and how long it will take. The emission analysis estimates the reduction in green house gasses given off by a site. The financial analysis gives an overall picture of the economic and energy models. Lastly, the risks show the possible economic uncertainties that may arise during the lifetime of the project.

APPENDIX H: MASSACHUSETTS TECHNOLOGY COLLABORATIVE

The Massachusetts Technology Collaborative (MTC) and their Commonwealth Solar program are focused on increasing the number of solar photovoltaic projects within the Commonwealth of Massachusetts. Commonwealth Solar provides rebates through a non-competitive application process for residential, commercial, industrial, and public facilities.

All non-residential projects are eligible for rebates on installations up to five hundred kilowatts, while residential projects are eligible for rebates on arrays up to five kilowatts. The refunds come in the form of mail-in rebates which are different those previously provided, which required multiple applications and often took years to receive.

The Commonwealth Solar program has $68 million for funding over the next four years. The funding is coming from $40 million that was invested by the Renewable Energy Trust and $28 million from the Alternative Compliance Payment. These funds were collected under the state's Renewable Standard program by the Massachusetts Division of Energy Resources.

The Renewable Energy Trust attempts to maximize environmental and economic benefits for the City of Boston by promoting clean energy technologies and promote a sustainable development. The Trust also provides financial assistance to individuals and businesses in search of implementing solar panels as well as works to promote green designs into Boston schools.

It is estimated that the entire Solar Commonwealth program will result in twenty-seven megawatts of photovoltaic projects over the next four years.

APPENDIX I: MTC REBATE ESTIMATOR

The Massachusetts Technology Collaborative (MTC) Rebate Estimator is a tool issued on the MTC webpage("Massachusetts Technology Collaborative: Commonwealth Solar," 2008). This tool uses the outputs from the Solar Pathfinder Assistant Software and the MTC Shading Calculator. It provides an estimate of the rebates given to those who install solar panels in Massachusetts. Also it provides a rough estimate of the total cost of the PV project.

The Rebate Estimator requires the user to input information regarding the solar project. The user inputs the total PV project size in watts dc, the system cost per watt, the annual net capacity factor, and information about the tax costs. With this information the Rebate Estimator calculates the net present value of the system, the simple payback, and the estimated return on value. It also provides a chart which displays this information on a year by year basis so the investor can see how long it will take to make a return on their investment. The MTC discusses the importance of getting a more detailed analysis from an installer.

Below is an example of the output that the MTC Rebate Estimator provides.

Figure 24: Example MTC Rebate Estimator Output Summary

Solar Project Financial Analysis Summary	
Scenario A: Net Present Value	$ (89,612)
Scenario A: Simple Payback (100% Cash only)	Year 23
Scenario A: Estimated Return on Equity	0.9%
Scenario A: Guess Return on Equity	50%
Scenario B: Net Present Value	$ (59,132)
Scenario B: Simple Payback (100% Cash only)	Year 18
Scenario B: Estimated Return on Equity	3.0%
Scenario B: Guess Return on Equity	50%

Figure 25: Example MTC Rebate Estimator Output

PRO FORMA AND PRODUCTION

Project Output	Start-Up 0	Year 1	Year 2	Year 3
Annual Generation (kWh)		52,560	52,297	52,036

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Start-Up 0	Year 1	Year 2	Year 3
INCOME STATEMENT				
Electricity Revenue (Avoided Cost)		$ 7,884	$ 8,080	$ 8,281
REC Revenue		$ 2,102	$ 2,092	$ 2,081
Total Revenue (Avoided Costs)		$ 9,986	$ 10,172	$ 10,362
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)
Inverter Replacement Cost		$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)
EBITDA		$ 9,736	$ 9,914	$ 10,097
Federal Depreciation Expense		$ (58,438)	$ (93,500)	$ (56,100)
EBIT		$ (48,701)	$ (83,586)	$ (46,003)
Interest Expense		$ -	$ -	$ -
EBT		$ (48,701)	$ (83,586)	$ (46,003)
Federal taxes saved/(paid)		$ 17,352	$ 29,567	$ 16,419
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ (876)	$ (892)	$ (909)
Net Income		**$ (32,225)**	**$ (54,911)**	**$ (30,493)**
CASH FLOW STATEMENT				
Cash From Operations				
Net Income		$ (32,225)	$ (54,911)	$ (30,493)
Federal Depreciation Expense		$ 58,438	$ 93,500	$ 56,100
Cash Flow From Operations		$ 26,212	$ 38,589	$ 25,607
Cash From Investing				
Installed PV Cost	$ (343,750)			
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ 20,109		
One Time Federal Solar Investment Tax Credit		$ 103,125		
Cash Flow From Investing	$ (343,750)	$ 123,234	$ -	$ -
Cash From Financing				
Loan Disbursement	$ -			
Loan Repayment (Principle)		$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ (343,750)**	**$ 149,447**	**$ 38,589**	**$ 25,607**
Cumulative Cash Flow	**$ (343,750)**	**$ (194,303)**	**$ (155,714)**	**$ (130,107)**

APPENDIX J: ECONOMIC CALCULATIONS

This section includes all of the figures to show the calculations made for previous arguments. The Massachusetts Technology Collaborative (MTC) Commonwealth Solar program offers both rebate estimators and project cost estimators. The amount of rebate received per kilowatt of panel installed can be seen in Figure 26 below.

Figure 26: MTC Non-Residential: Commonwealth Solar Rebate Matrix ($/watt dc)

Incremental Capacity		**1 to 25 kW** (1,000 to 25,000 watts)	**> 25 to 100 kW**	**> 100 kW to 200 kW**	**> 200 kW to 500 kW**
	Base Incentive ($/watt dc)	$3.25	$2.50	$2.00	$1.50
PLUS: Additions to Base					
	MA-Manufactured Components	$0.25	$0.25	$0.25	$0.25
	Public Building Adder	$0.50	$0.50	$0.25	$0.25

MTC REBATE ESTIMATOR

Figure 27: City Hall MTC Rebate Estimator Inputs for Boston's City Hall

Non-Residential: Commonwealth Solar Rebate Calculator	
Total PV Project Size (watts dc)	**10,000**
Total PV Project Size for Rebate Calculation (500 kW cap)	**10,000**
MA-manufactured components	YES
Public Building Adder	NO
Rebate ($)	**$ -**
Rebate ($/watt dc) based on total project size	**$ -**
Key	
Entry Cells	
Calculation Cells (not for Entry)	

Figure 28: City Hall MTC Rebate Estimator Summary

Solar Project Financial Analysis Summary	
Scenario A: Net Present Value	$ (42,893)
Scenario A: Simple Payback (100% Cash only)	Year
Scenario A: Estimated Return on Equity	#DIV/0!
Scenario A: Guess Return on Equity	50%
Scenario B: Net Present Value	$ (42,893)
Scenario B: Simple Payback (100% Cash only)	Year
Scenario B: Estimated Return on Equity	#DIV/0!
Scenario B: Guess Return on Equity	50%

NET CAPACITY FACTOR

The net capacity factor is an important part of our project. It is a numeric value for efficiency that reflects the amount of solar irradiance that an area receives. The equation that can be used to calculate the net capacity factor can be seen in Equation 1 below.

Equation 1: Net Capacity Factor

$$\frac{Net\ Actual\ Generation}{(Period\ Hours) \times (Max\ Capacity)} = Net\ Capacity\ Factor$$

SIMPLE PAYBACK

Simple payback is a calculation that determines how long it will take for the entire investment to be regained through profits and savings. From this value, it can be determined whether or not an investment is worth making. The lower the number for the simple payback value, the better the investment because the funds will be regained in a shorter amount of time. The equation to calculate this value can be found below in Equation 2.

Equation 2: Simple Payback

$$\frac{Energy\ Cost\ Savings}{Initial\ Cost\ of\ Installation} = Simple\ Payback$$

NET PRESENT VALUE

The net present value represents the current worth of a project. This value incorporates start-up costs and amount saved from electricity costs. The equation for this calculation can be found below in Equation 3.

Equation 3: Net Present Value

$$\mathrm{NPV} = \sum_{t=0}^{N} \frac{C_t}{(1+r)^t}$$

Where:

t - the time of the cash flow

N - the total time of the project

r - the discount rate (the rate of return that could be earned on an investment in the financial markets with similar risk.)

C_t - the net cash flow (the amount of cash) at time t (for educational purposes, C_0 is commonly placed to the left of the sum to emphasize its role as the initial investment.).

APPENDIX K: PHOTOVOLTAIC SITE PROFILES

BRIGHTON HIGH SCHOOL

Table 19: Brighton High School PV Profile

Building	
Building Name	Brighton High School
Building Address	25 Warren Street Brighton, MA
City Department	Boston Public Schools
Number of floors	3
Square footage (if known)	
Fuel Type(s)	Fuel Oil/Natural Gas
Contact Information	
Facilities Manager	Mike Messersmith
Phone	617-635-9873
Email	
Electrical Connection	
Electric Utility Company	
Floor Plan showing Electrical room	Yes / No
Roof Details	
Roof slope/angle (Flat = 0^{o})	0^{o}
Roof Orientation (S, SE, SW, etc.)	N/A
Roof Size – Square Feet	216,213 sq ft
Digital Photos of Roof Available?	Yes / No
Roof Condition: poor, fair, good, excellent, new	Good
Roof Type (asphalt, shingles, rubber membrane, etc.)	Rubber
Expected life of roof (years)	
Equipment/obstructions on the roof	Skylights

Table 20: Brighton High School Summary of Findings

Summary of Findings	
Suited for Solar Water Heating?	Yes / No
Site Efficiency	96.15%
Area of roof available for panel installation	86,485.2 sq ft
Maximum number of panels that can be installed	1,000
DC Output of maximum number of panels	31,145 W
Net Capacity Factor (%)	12.8 %
Cost of Installation:	

Figure 29: Brighton High School Solar Pathfinder Report

WPI Solar Team and Solar Boston Site Report

Report Name	Brighton High School
Report Date	4/4/2008 10:57:46 AM
Declination	-15d 11m
Location	BRIGHTON, MA, Zipcode: 02135
Lat/Long	42.35 / -71.105
Weather Station	Boston, MA, Elevation: 6 m
Site distance	1.95 miles
Array Type	Fixed
Tilt Angle	42.35 deg
Ideal Tilt Angle	42.33 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Make	Evergreen Solar
Panel Model	ES-195-RL
Panel Count	1000
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	Custom
Layout Point Count	5

Notes: [None]
City of Boston Environment Department
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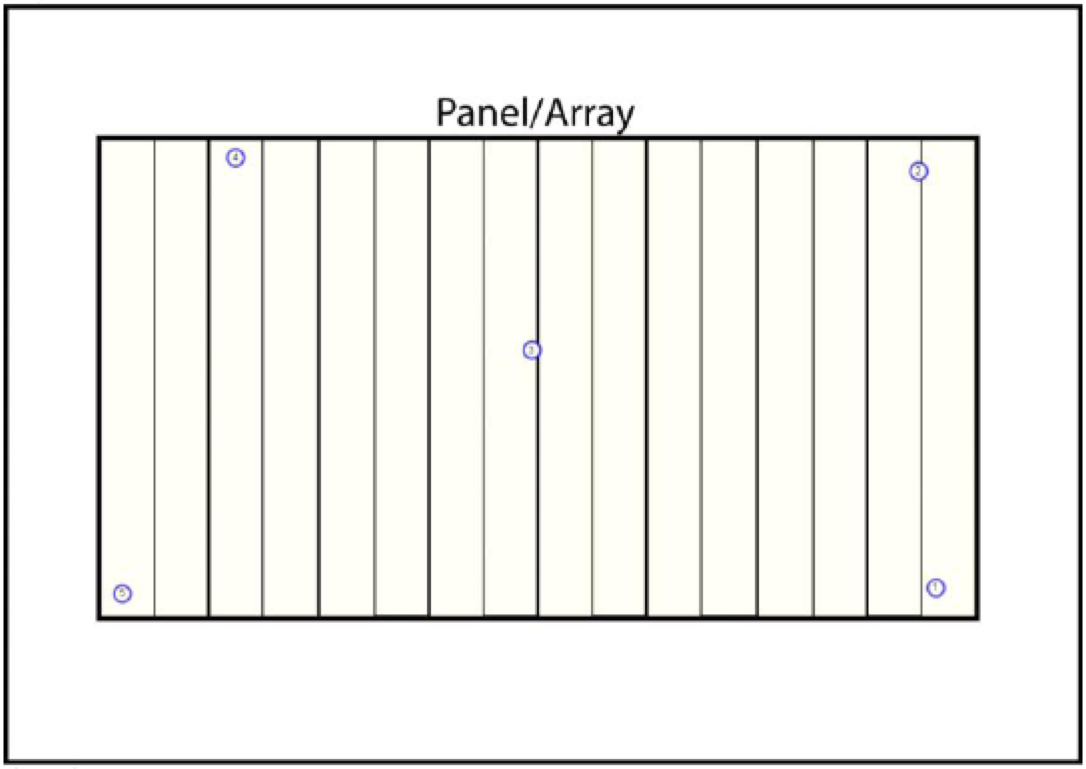
WPI Solar Team and Solar Boston System Picture Layout

Layout Type Custom
Layout Point Count 5



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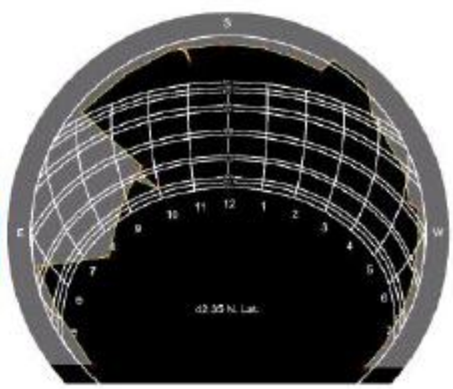
WPI Solar Team and Solar E 1 st
Solar Site Analysis Report

Image File BrightonHigh 1.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m² /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	97.00%	2.41	12418.00	12266.33
February	94.00%	3.10	14653.00	13881.27
March	84.00%	3.51	20426.00	17163.84
April	81.00%	3.63	20309.00	16430.63
May	86.00%	4.37	23177.00	19849.69
June	89.00%	5.11	24258.00	21626.52
July	89.00%	4.80	23371.00	20928.69
August	77.00%	3.91	22246.00	17251.08
September	80.00%	4.10	22573.00	17992.63
October	89.00%	3.43	17754.00	15870.72
November	94.00%	2.58	12722.00	12147.31
December	97.00%	2.27	11646.00	11410.92
Totals	**88.05%**	**43.23**	**225553.0**	**196819.62**
	Unweighted Yearly Avg	**Effect: 86.75% Sun Hrs: 3.60**		

Notes: [None]



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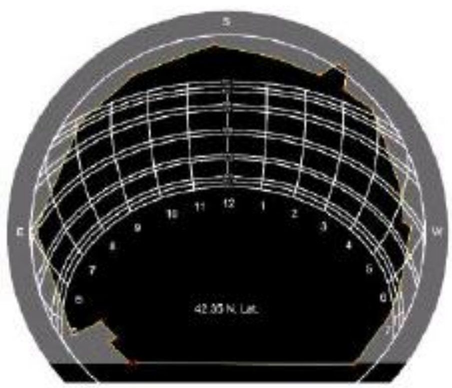
WPI Solar Team and Solar Boston
Solar Site Analysis Report

Image File BrightonHigh 2.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m² /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	98.00%	2.43	12418.00	12340.33
February	97.00%	3.20	14653.00	14305.93
March	99.00%	4.16	20426.00	20389.83
April	99.00%	4.47	20309.00	20287.12
May	99.00%	5.06	23177.00	23159.15
June	99.00%	5.67	24258.00	24235.96
July	99.00%	5.33	23371.00	23359.18
August	99.00%	5.02	22246.00	22227.84
September	99.00%	5.10	22573.00	22518.77
October	97.00%	3.73	17754.00	17311.36
November	97.00%	2.66	12722.00	12480.65
December	97.00%	2.25	11646.00	11352.15
Totals	**98.27%**	**49.10**	**225553.0**	**223968.27**
	Unweighted Yearly Avg	**Effect: 98.53% Sun Hrs: 4.09**		

Notes: [None]



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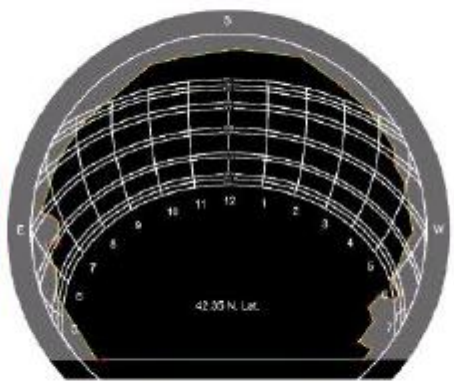
WPI Solar Team and Solar B3st
Solar Site Analysis Report

Image File BrightonHigh 3.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	97.00%	2.41	12418.00	12251.25
February	98.00%	3.23	14653.00	14402.83
March	99.00%	4.17	20426.00	20398.40
April	98.00%	4.43	20309.00	20135.99
May	99.00%	5.05	23177.00	23147.60
June	99.00%	5.67	24258.00	24234.41
July	99.00%	5.32	23371.00	23355.60
August	99.00%	4.98	22246.00	22128.49
September	98.00%	5.07	22573.00	22394.55
October	98.00%	3.77	17754.00	17480.44
November	97.00%	2.65	12722.00	12443.45
December	94.00%	2.19	11646.00	11060.66
Totals	**97.89%**	**48.95**	**225553.0**	**223433.69**
	Unweighted Yearly Avg	**Effect: 98.22% Sun Hrs: 4.08**		

Notes: [None]



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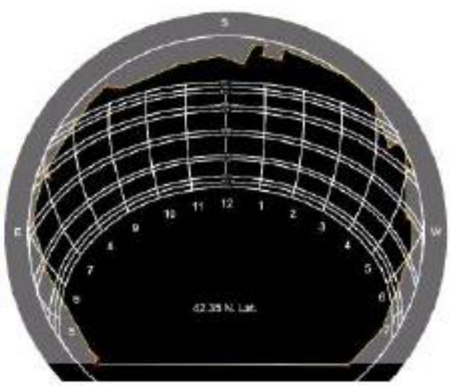
WPI Solar Team and Solar B 4 st
Solar Site Analysis Report

Image File BrightonHigh 4.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	99.00%	2.45	12418.00	12384.60
February	100.00%	3.30	14653.00	14638.51
March	99.00%	4.18	20426.00	20411.13
April	100.00%	4.49	20309.00	20309.00
May	99.00%	5.06	23177.00	23156.94
June	99.00%	5.66	24258.00	24223.53
July	99.00%	5.33	23371.00	23357.31
August	99.00%	5.03	22246.00	22245.10
September	99.00%	5.11	22573.00	22510.23
October	99.00%	3.83	17754.00	17677.80
November	98.00%	2.69	12722.00	12567.13
December	98.00%	2.29	11646.00	11528.46
Totals	**99.09%**	**49.41**	**225553.0**	**225009.74**
	Unweighted Yearly Avg	**Effect: 99.15% Sun Hrs: 4.12**		

Notes: [None]



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WPI Solar Team and Solar E 5 st
Solar Site Analysis Report

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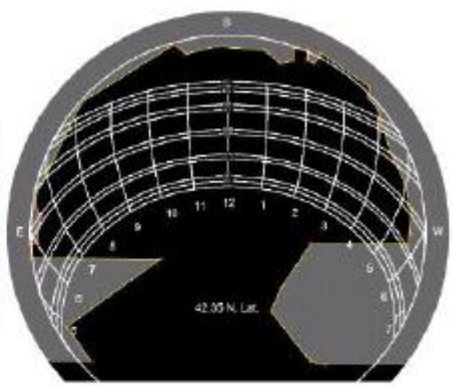
Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	99.00%	2.45	12418.00	12375.81
February	98.00%	3.24	14653.00	14407.89
March	99.00%	4.17	20426.00	20398.65
April	99.00%	4.47	20309.00	20288.75
May	95.00%	4.87	23177.00	22577.40
June	92.00%	5.24	24258.00	22913.94
July	95.00%	5.09	23371.00	22660.17
August	98.00%	4.98	22246.00	22131.63
September	99.00%	5.11	22573.00	22488.67
October	99.00%	3.81	17754.00	17622.47
November	98.00%	2.69	12722.00	12591.93
December	99.00%	2.32	11646.00	11646.00
Totals	**97.55%**	**48.43**	**225553.0**	**222103.31**
	Unweighted Yearly Avg	**Effect: 97.19% Sun Hrs: 4.04**		

Notes: [None]



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WPI Solar Team and Solar Bost Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	98.00%	2.43	12418.00	12323.66
February	97.40%	3.21	14653.00	14327.29
March	96.00%	4.04	20426.00	19752.37
April	95.40%	4.30	20309.00	19490.30
May	95.60%	4.88	23177.00	22378.16
June	95.60%	5.47	24258.00	23446.87
July	96.20%	5.17	23371.00	22732.19
August	94.40%	4.78	22246.00	21196.83
September	95.00%	4.90	22573.00	21580.97
October	96.40%	3.71	17754.00	17192.56
November	96.80%	2.65	12722.00	12446.09
December	97.00%	2.26	11646.00	11399.64
Totals	**96.15%**	**43.23**	**225553.0**	**218266.92**
	Unweighted	**Effect: 95.97%**		
	Yearly Avg	**Sun Hrs: 3.99**		

Notes: [None]

City of Boston Environment Department

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Table 21: Brighton High School MTC Rebate Estimator Summary

Commonwealth Solar Non-Residential Solar Photovoltaic Calculator

Non-Residential: Commonwealth Solar Rebate Matrix ($/watt dc)				
Incremental Capacity	**1 to 25 kW** (1,000 to 25,000 watts)	**> 25 to 100 kW**	**> 100 kW to 200 kW**	**> 200 kW to 500 kW**
Base Incentive ($/watt dc)	$3.25	$2.50	$2.00	$1.50
PLUS: Additions to Base				
MA-Manufactured Components	$0.25	$0.25	$0.25	$0.25
Public Building Adder	$0.50	$0.50	$0.25	$0.25

Non-Residential: Commonwealth Solar Rebate Calculator	
Total PV Project Size (watts dc)	**31,145**
Total PV Project Size for Rebate Calculation (500 kW cap)	**31,145**
MA-manufactured components	YES
Public Building Adder	YES
Rebate ($)	**$ 119,971.25**
Rebate ($/watt dc) based on total project size	**$ 3.85202**
Key	
Entry Cells	(green)
Calculation Cells (not for Entry)	(yellow)

Click here for Financial Model

DATA ENTRY AND FINANCIAL SUMMARY

Key

Entry Cells	(green)
Cells Draw Data from Another Worksheet	(yellow)
Calculation Cells (Not for Entry)	(white)

Select Taxable or Non-Taxable Entity	Non-Taxable	
Project and Customer Cost Assumptions		
Solar Photovoltaic System Size	31,145	Watts (DC STC)
Total System Cost/Watt	$ 7.00	$/Watt (DC STC)
Total System Cost	$ 218,015	
MTC Rebate Assumptions		
MTC Scenario A: Non-Taxable Rebate	$ 3.852	$/Watt (DC STC)
Scenario A Rebate	$ 119,971	
MTC Scenario B: Taxable Rebate	$ 4.012	$/Watt (DC STC)
Scenario B Rebate	$ 124,954	
Project Performance and Savings/ Cost Assumptions		
Annual Net Capacity Factor	12.8%	kW (DC STC) to kWh AC
Annual Production Degradation	0.50%	%
Project Life	25	Years
Electricity Revenue (Avoided Costs)	$ 0.15	$/kWh
Electricity Revenue (Avoided Costs) Annual Adjustor	5.0%	%
Renewable Energy Certificate (REC) Revenue	$ 0.03	$/kWh
REC Revenue Annual Adjustor	0.0%	%
REC Revenue Term	3	Years (must be equal to or less than project life)
Annual Operations and Maintenance Cost	$ 250	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.75	$/Watt (DC STC)
Inverter Life, Replace Every X Years	15	Year (must be equal to or less than project life)

Scenario Definitions

Scenario A: Non-Taxable Rebate - Assumes that the state rebate is non-taxable, but is subtracted from the cost basis for purposes of determi

Scenario B: Taxable Rebate - Assumes that the state rebate is taxable, but is not subtracted from the cost basis for purposes of determining t

Both Scenarios assume that the project owner can use both federal and state tax benefits

Tax Assumptions

Federal Tax Rate	0%					
State Tax Rate	0%					
Effective Tax Rate	0%					
Federal Tax Credit	0%					
State Tax Deduction	0%					
5 Year Accelerated Depreciation Schedule (MACRS)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Financing Assumptions

% Financed w/ Cash	100%	
% Financed w/ Loan	0%	
Loan Interest Rate	8%	
Loan Period	20	Years (must be equal to or less than project life)
Scenario A Net Cost	$ 98,044	
Scenario A Loan	$ -	
Scenario B Net Cost	$ 93,061	
Scenario B Loan	$ -	
Customer Discount Rate	6%	

Solar Project Financial Analysis Summary

Scenario A: Net Present Value	**$ (4,961)**
Scenario A: Simple Payback (100% Cash only)	**Year 17**
Scenario A: Estimated Return on Equity	**#DIV/0!**
Scenario A: Guess Return on Equity	50%
Scenario B: Net Present Value	**$ 21**
Scenario B: Simple Payback (100% Cash only)	**Year 14**
Scenario B: Estimated Return on Equity	**#DIV/0!**
Scenario B: Guess Return on Equity	50%

PRO FORMA AND PRODUCTION

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Annual Generation (kWh)		34,895	34,721	34,547	34,374	34,202	34,031

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 5,234	$ 5,468	$ 5,713	$ 5,969	$ 6,236	$ 6,515
REC Revenue		$ 1,047	$ 1,042	$ 1,036	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 6,281	$ 6,510	$ 6,750	$ 5,969	$ 6,236	$ 6,515
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 6,031	$ 6,253	$ 6,484	$ 5,696	$ 5,955	$ 6,225
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 6,031	$ 6,253	$ 6,484	$ 5,696	$ 5,955	$ 6,225
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 6,031	$ 6,253	$ 6,484	$ 5,696	$ 5,955	$ 6,225
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Net Income		**$ 6,031**	**$ 6,253**	**$ 6,484**	**$ 5,696**	**$ 5,955**	**$ 6,225**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 6,031	$ 6,253	$ 6,484	$ 5,696	$ 5,955	$ 6,225
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 6,031	$ 6,253	$ 6,484	$ 5,696	$ 5,955	$ 6,225
Cash From Investing							
Installed PV Cost	$ (98,044)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (98,044)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ (98,044)**	**$ 6,031**	**$ 6,253**	**$ 6,484**	**$ 5,696**	**$ 5,955**	**$ 6,225**
Cumulative Cash Flow	**$ (98,044)**	**$ (92,013)**	**$ (85,760)**	**$ (79,276)**	**$ (73,580)**	**$ (67,625)**	**$ (61,400)**

PRO FORMA AND PRODUCTION

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Annual Generation (kWh)	33,861	33,692	33,523	33,356	33,189	33,023	32,858

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 6,807	$ 7,111	$ 7,429	$ 7,762	$ 8,109	$ 8,472	$ 8,851
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 6,807	$ 7,111	$ 7,429	$ 7,762	$ 8,109	$ 8,472	$ 8,851
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 6,508	$ 6,804	$ 7,113	$ 7,436	$ 7,773	$ 8,126	$ 8,495
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 6,508	$ 6,804	$ 7,113	$ 7,436	$ 7,773	$ 8,126	$ 8,495
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 6,508	$ 6,804	$ 7,113	$ 7,436	$ 7,773	$ 8,126	$ 8,495
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 6,508**	**$ 6,804**	**$ 7,113**	**$ 7,436**	**$ 7,773**	**$ 8,126**	**$ 8,495**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 6,508	$ 6,804	$ 7,113	$ 7,436	$ 7,773	$ 8,126	$ 8,495
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 6,508	$ 6,804	$ 7,113	$ 7,436	$ 7,773	$ 8,126	$ 8,495
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 6,508**	**$ 6,804**	**$ 7,113**	**$ 7,436**	**$ 7,773**	**$ 8,126**	**$ 8,495**
Cumulative Cash Flow	**$ (54,892)**	**$ (48,088)**	**$ (40,976)**	**$ (33,540)**	**$ (25,767)**	**$ (17,641)**	**$ (9,146)**

PRO FORMA AND PRODUCTION

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Annual Generation (kWh)	32,694	32,530	32,368	$ 32,206	32,045	31,884	31,725

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 9,247	$ 9,661	$ 10,093	$ 10,545	$ 11,017	$ 11,510	$ 12,025
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 9,247	$ 9,661	$ 10,093	$ 10,545	$ 11,017	$ 11,510	$ 12,025
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (23,359)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (23,737)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 8,880	$ (14,076)	$ 9,704	$ 10,144	$ 10,604	$ 11,084	$ 11,587
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 8,880	$ (14,076)	$ 9,704	$ 10,144	$ 10,604	$ 11,084	$ 11,587
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 8,880	$ (14,076)	$ 9,704	$ 10,144	$ 10,604	$ 11,084	$ 11,587
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 8,880**	**$ (14,076)**	**$ 9,704**	**$ 10,144**	**$ 10,604**	**$ 11,084**	**$ 11,587**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 8,880	$ (14,076)	$ 9,704	$ 10,144	$ 10,604	$ 11,084	$ 11,587
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 8,880	$ (14,076)	$ 9,704	$ 10,144	$ 10,604	$ 11,084	$ 11,587
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 8,880**	**$ (14,076)**	**$ 9,704**	**$ 10,144**	**$ 10,604**	**$ 11,084**	**$ 11,587**
Cumulative Cash Flow	**$ (266)**	**$ (14,342)**	**$ (4,638)**	**$ 5,506**	**$ 16,110**	**$ 27,195**	**$ 38,781**

PRO FORMA AND PRODUCTION

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Annual Generation (kWh)	31,566	31,409	31,251	31,095	30,940

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 21	Year 22	Year 23	Year 24	Year 25
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 12,563	$ 13,125	$ 13,713	$ 14,326	$ 14,968
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 12,563	$ 13,125	$ 13,713	$ 14,326	$ 14,968
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 12,112	$ 12,660	$ 13,234	$ 13,833	$ 14,459
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 12,112	$ 12,660	$ 13,234	$ 13,833	$ 14,459
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 12,112	$ 12,660	$ 13,234	$ 13,833	$ 14,459
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 12,112**	**$ 12,660**	**$ 13,234**	**$ 13,833**	**$ 14,459**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 12,112	$ 12,660	$ 13,234	$ 13,833	$ 14,459
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 12,112	$ 12,660	$ 13,234	$ 13,833	$ 14,459
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 12,112**	**$ 12,660**	**$ 13,234**	**$ 13,833**	**$ 14,459**
Cumulative Cash Flow	**$ 50,893**	**$ 63,553**	**$ 76,787**	**$ 90,620**	**$ 105,080**

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 5,234	$ 5,468	$ 5,713	$ 5,969	$ 6,236	$ 6,515
REC Revenue		$ 1,047	$ 1,042	$ 1,036	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 6,281	$ 6,510	$ 6,750	$ 5,969	$ 6,236	$ 6,515
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 6,031	$ 6,253	$ 6,484	$ 5,696	$ 5,955	$ 6,225
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 6,031	$ 6,253	$ 6,484	$ 5,696	$ 5,955	$ 6,225
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 6,031	$ 6,253	$ 6,484	$ 5,696	$ 5,955	$ 6,225
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate		$ -					
Net Income		**$ 6,031**	**$ 6,253**	**$ 6,484**	**$ 5,696**	**$ 5,955**	**$ 6,225**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 6,031	$ 6,253	$ 6,484	$ 5,696	$ 5,955	$ 6,225
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 6,031	$ 6,253	$ 6,484	$ 5,696	$ 5,955	$ 6,225
Cash From Investing							
Installed PV Cost	$ (93,061)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (93,061)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ (93,061)**	**$ 6,031**	**$ 6,253**	**$ 6,484**	**$ 5,696**	**$ 5,955**	**$ 6,225**
Cumulative Cash Flow	**$ (93,061)**	**$ (87,030)**	**$ (80,778)**	**$ (74,293)**	**$ (68,598)**	**$ (62,643)**	**$ (56,418)**

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 6,807	$ 7,111	$ 7,429	$ 7,762	$ 8,109	$ 8,472	$ 8,851
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 6,807	$ 7,111	$ 7,429	$ 7,762	$ 8,109	$ 8,472	$ 8,851
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 6,508	$ 6,804	$ 7,113	$ 7,436	$ 7,773	$ 8,126	$ 8,495
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 6,508	$ 6,804	$ 7,113	$ 7,436	$ 7,773	$ 8,126	$ 8,495
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 6,508	$ 6,804	$ 7,113	$ 7,436	$ 7,773	$ 8,126	$ 8,495
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 6,508**	**$ 6,804**	**$ 7,113**	**$ 7,436**	**$ 7,773**	**$ 8,126**	**$ 8,495**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 6,508	$ 6,804	$ 7,113	$ 7,436	$ 7,773	$ 8,126	$ 8,495
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 6,508	$ 6,804	$ 7,113	$ 7,436	$ 7,773	$ 8,126	$ 8,495
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 6,508**	**$ 6,804**	**$ 7,113**	**$ 7,436**	**$ 7,773**	**$ 8,126**	**$ 8,495**
Cumulative Cash Flow	**$ (49,910)**	**$ (43,106)**	**$ (35,993)**	**$ (28,558)**	**$ (20,784)**	**$ (12,658)**	**$ (4,164)**

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 9,247	$ 9,661	$ 10,093	$ 10,545	$ 11,017	$ 11,510	$ 12,025
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 9,247	$ 9,661	$ 10,093	$ 10,545	$ 11,017	$ 11,510	$ 12,025
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (23,359)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (23,737)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 8,880	$ (14,076)	$ 9,704	$ 10,144	$ 10,604	$ 11,084	$ 11,587
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 8,880	$ (14,076)	$ 9,704	$ 10,144	$ 10,604	$ 11,084	$ 11,587
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 8,880	$ (14,076)	$ 9,704	$ 10,144	$ 10,604	$ 11,084	$ 11,587
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 8,880**	**$ (14,076)**	**$ 9,704**	**$ 10,144**	**$ 10,604**	**$ 11,084**	**$ 11,587**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 8,880	$ (14,076)	$ 9,704	$ 10,144	$ 10,604	$ 11,084	$ 11,587
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 8,880	$ (14,076)	$ 9,704	$ 10,144	$ 10,604	$ 11,084	$ 11,587
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 8,880**	**$ (14,076)**	**$ 9,704**	**$ 10,144**	**$ 10,604**	**$ 11,084**	**$ 11,587**
Cumulative Cash Flow	**$ 4,717**	**$ (9,359)**	**$ 345**	**$ 10,489**	**$ 21,093**	**$ 32,177**	**$ 43,764**

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Scenario B: Taxable Rebate; Pro Forma Project Economics					
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 12,563	$ 13,125	$ 13,713	$ 14,326	$ 14,968
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 12,563	$ 13,125	$ 13,713	$ 14,326	$ 14,968
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 12,112	$ 12,660	$ 13,234	$ 13,833	$ 14,459
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 12,112	$ 12,660	$ 13,234	$ 13,833	$ 14,459
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 12,112	$ 12,660	$ 13,234	$ 13,833	$ 14,459
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate					
Net Income	**$ 12,112**	**$ 12,660**	**$ 13,234**	**$ 13,833**	**$ 14,459**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 12,112	$ 12,660	$ 13,234	$ 13,833	$ 14,459
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 12,112	$ 12,660	$ 13,234	$ 13,833	$ 14,459
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 12,112**	**$ 12,660**	**$ 13,234**	**$ 13,833**	**$ 14,459**
Cumulative Cash Flow	**$ 55,875**	**$ 68,536**	**$ 81,770**	**$ 95,603**	**$ 110,062**

CENTRAL MAINTENANCE FACILITY

Table 22: Central Maintenance Facility PV Profile

Building	
Building Name	Central Maintenance
Building Address	400 Frontage Road
City Department	Boston Public Works
Number of floors	
Square footage (if known)	
Fuel Type(s)	Steam
Contact Information	
Facilities Manager	George Haffner
Phone	617-635-7555
Email	
Electrical Connection	
Electric Utility Company	
Floor Plan showing Electrical room	Yes / No
Roof Details	
Roof slope/angle (Flat = 0^{o})	Flat
Roof Orientation (S, SE, SW, etc.)	N/A
Roof Size – Square Feet	82599.5 sq ft
Roof Condition: poor, fair, good, excellent, new	Good
Roof Type (asphalt, shingles, rubber membrane, etc.)	Rubber
Expected life of roof (years)	
Equipment/obstructions on the roof	Small Exhaust Vents
Detailed Roof Drawings available	Yes / No

Table 23: Central Maintenance Summary of Findings

Summary of Findings	
Suited for Solar Water Heating?	Yes
Site Efficiency	98.63%
Area of roof available for panel installation	33,039 sq ft
Maximum number of panels that can be installed	1,000
DC Output of maximum number of panels	31,954 W
Net Capacity Factor (%)	13.1 %
Cost of Installation:	

Figure 30: Central Maintenance Solar Pathfinder Report

WPI Solar Team and Solar Boston Site Report

Report Name	400 Frontage Rd
Report Date	4/2/2008 2:03:17 PM
Declination	-15d 12m
Location	BOSTON, MA, Zipcode: 02118
Lat/Long	42.336 / -71.073
Weather Station	Boston, MA, Elevation: 6 m
Site distance	1.01 miles
Array Type	Fixed
Tilt Angle	42.34 deg
Ideal Tilt Angle	42.33 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Make	Evergreen Solar
Panel Model	ES-195-RL
Panel Count	1000
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	Custom
Layout Point Count	6

Notes: [None]
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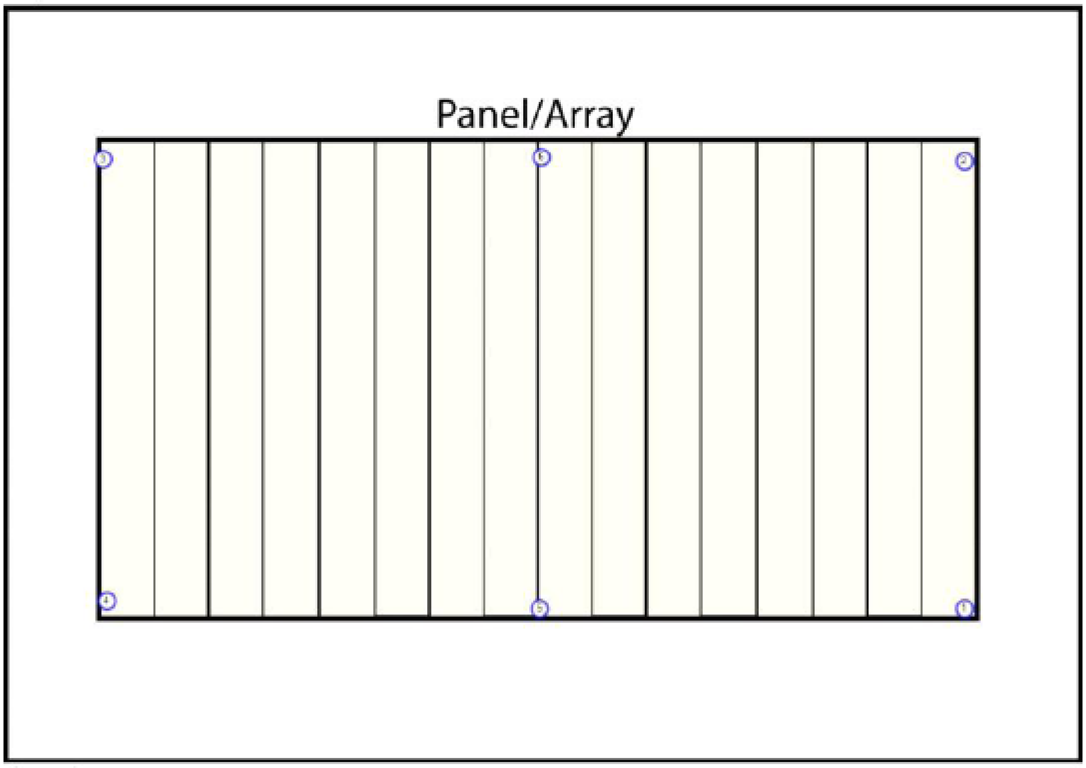
WPI Solar Team and Solar Boston System Picture Layout

Layout Type Custom
Layout Point Count 6



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WPI Solar Team and Solar E 1 st Solar Site Analysis Report

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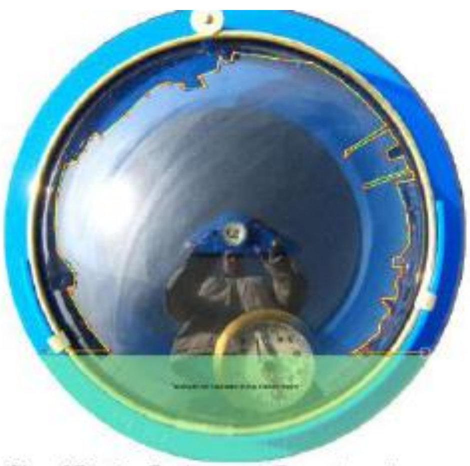
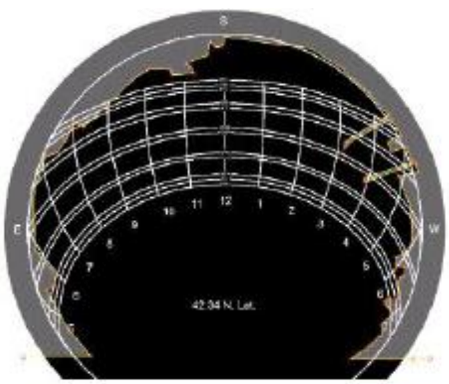
Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.34	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.34 $KWH/m^2/day$	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	97.00%	2.41	12417.00	12205.21
February	99.00%	3.27	14652.00	14479.36
March	99.00%	4.17	20425.00	20355.40
April	100.00%	4.48	20310.00	20306.62
May	99.00%	5.08	23179.00	23167.33
June	99.00%	5.68	24260.00	24243.37
July	100.00%	5.35	23371.00	23365.09
August	99.00%	5.02	22247.00	22237.47
September	99.00%	5.11	22573.00	22465.41
October	99.00%	3.81	17752.00	17616.77
November	95.00%	2.62	12719.00	12262.60
December	93.00%	2.17	11646.00	10942.32
Totals	**98.24%**	**49.17**	**225551.0**	**223646.94**
	Unweighted Yearly Avg	**Effect: 98.67% Sun Hrs: 4.10**		

Notes: [None]





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WPI Solar Team and Solar B2st Solar Site Analysis Report

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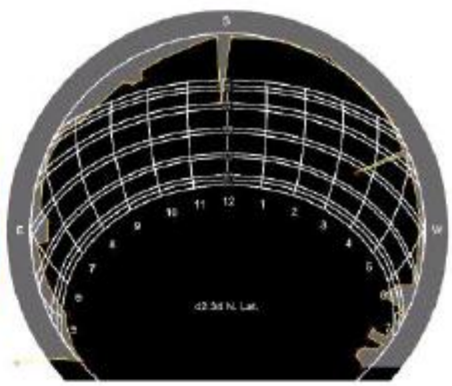
Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.34	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.34 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	98.00%	2.43	12417.00	12170.73
February	99.00%	3.29	14652.00	14585.16
March	99.00%	4.18	20425.00	20395.10
April	100.00%	4.49	20310.00	20310.00
May	99.00%	5.07	23179.00	23166.65
June	99.00%	5.68	24260.00	24238.52
July	99.00%	5.34	23371.00	23360.34
August	100.00%	5.05	22247.00	22246.35
September	99.00%	5.08	22573.00	22358.15
October	99.00%	3.83	17752.00	17696.93
November	98.00%	2.69	12719.00	12537.51
December	95.00%	2.21	11646.00	11093.53
Totals	**98.76%**	**49.34**	**225551.0**	**224158.98**
	Unweighted Yearly Avg	**Effect: 99.01% Sun Hrs: 4.11**		

Notes: [None]



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WPI Solar Team and Solar B 3 st
Solar Site Analysis Report

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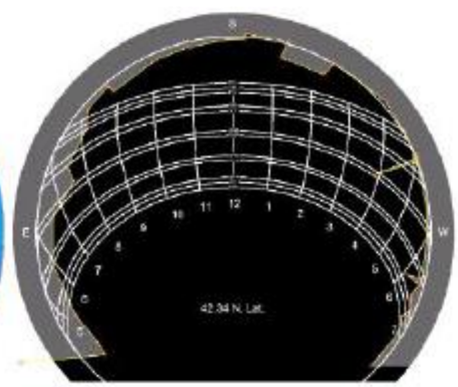
Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.34	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.34 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	99.00%	2.46	12417.00	12376.01
February	99.00%	3.27	14652.00	14557.68
March	98.00%	4.10	20425.00	20101.64
April	100.00%	4.49	20310.00	20286.49
May	99.00%	5.08	23179.00	23162.51
June	99.00%	5.68	24260.00	24238.74
July	100.00%	5.35	23371.00	23363.38
August	100.00%	5.04	22247.00	22246.05
September	98.00%	5.07	22573.00	22321.10
October	98.00%	3.78	17752.00	17456.35
November	98.00%	2.68	12719.00	12473.62
December	99.00%	2.31	11646.00	11557.84
Totals	**98.85%**	**49.30**	**225551.0**	**224141.41**
	Unweighted Yearly Avg	**Effect: 98.93% Sun Hrs: 4.11**		

Notes: [None]



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WPI Solar Team and Solar E4st
Solar Site Analysis Report

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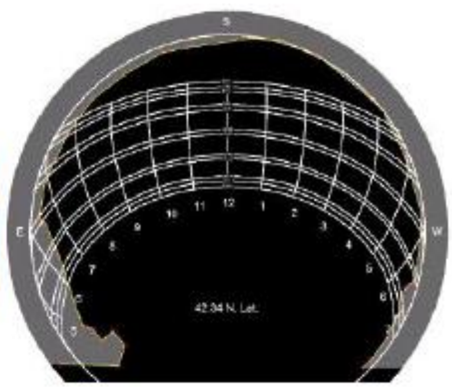
Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.34	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.34 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	100.00%	2.48	12417.00	12413.61
February	99.00%	3.29	14652.00	14623.01
March	100.00%	4.18	20425.00	20401.78
April	99.00%	4.46	20310.00	20192.44
May	98.00%	5.03	23179.00	23031.60
June	99.00%	5.65	24260.00	24187.14
July	99.00%	5.32	23371.00	23306.59
August	99.00%	5.00	22247.00	22111.84
September	99.00%	5.11	22573.00	22458.75
October	100.00%	3.84	17752.00	17725.89
November	98.00%	2.70	12719.00	12596.01
December	99.00%	2.31	11646.00	11587.22
Totals	**99.10%**	**49.37**	**225551.0**	**224635.88**
	Unweighted Yearly Avg	**Effect: 99.06% Sun Hrs: 4.11**		

Notes: [None]



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WPI Solar Team and Solar B 5 st
Solar Site Analysis Report

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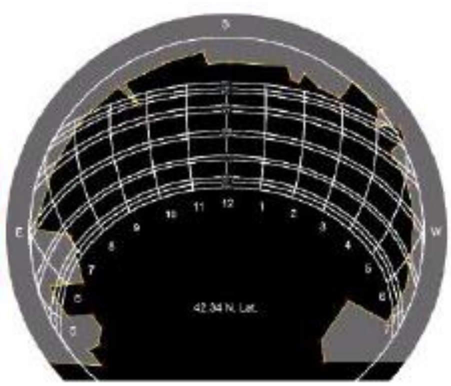
Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.34	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.34 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	99.00%	2.46	12417.00	12335.88
February	98.00%	3.24	14652.00	14443.17
March	99.00%	4.17	20425.00	20403.06
April	98.00%	4.43	20310.00	20093.78
May	97.00%	4.93	23179.00	22601.41
June	97.00%	5.56	24260.00	23741.53
July	98.00%	5.25	23371.00	23015.18
August	98.00%	4.94	22247.00	21921.79
September	99.00%	5.12	22573.00	22513.22
October	99.00%	3.80	17752.00	17601.55
November	98.00%	2.68	12719.00	12545.12
December	97.00%	2.25	11646.00	11313.97
Totals	**98.01%**	**48.83**	**225551.0**	**222529.65**
	Unweighted Yearly Avg	**Effect: 97.99% Sun Hrs: 4.07**		

Notes: [None]



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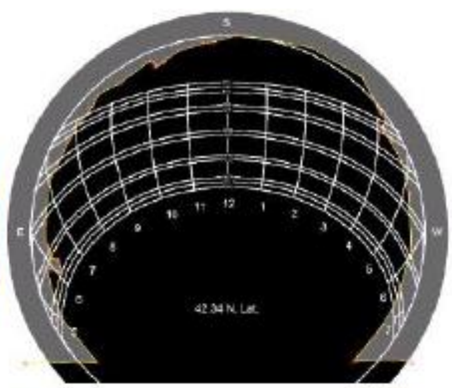
WPI Solar Team and Solar E 6 st
Solar Site Analysis Report

Image File 400 frontage 6.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.34	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.34 KWH/m² /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	99.00%	2.45	12417.00	12366.37
February	99.00%	3.26	14652.00	14521.02
March	99.00%	4.16	20425.00	20377.75
April	99.00%	4.47	20310.00	20251.22
May	99.00%	5.07	23179.00	23165.85
June	99.00%	5.69	24260.00	24250.14
July	100.00%	5.34	23371.00	23362.67
August	99.00%	5.01	22247.00	22186.37
September	99.00%	5.08	22573.00	22415.33
October	99.00%	3.80	17752.00	17592.77
November	97.00%	2.67	12719.00	12539.47
December	98.00%	2.29	11646.00	11499.06
Totals	**98.80%**	**49.30**	**225551.0**	**224528.01**
	Unweighted Yearly Avg	**Effect: 98.93% Sun Hrs: 4.11**		

Notes: [None]



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WPI Solar Team and Solar Bost Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.34	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.34 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	98.67%	2.45	12417.00	12311.30
February	98.83%	3.27	14652.00	14534.90
March	99.00%	4.16	20425.00	20339.12
April	99.33%	4.47	20310.00	20240.09
May	98.50%	5.04	23179.00	23049.23
June	98.67%	5.66	24260.00	24149.91
July	99.33%	5.33	23371.00	23295.54
August	99.17%	5.01	22247.00	22158.31
September	98.83%	5.10	22573.00	22421.99
October	99.00%	3.81	17752.00	17615.04
November	97.33%	2.67	12719.00	12492.39
December	96.83%	2.26	11646.00	11332.32
Totals	**98.63%**	**49.17**	**225551.0**	**223940.15**
	Unweighted Yearly Avg	**Effect: 98.77% Sun Hrs: 4.10**		

Notes: [None]

City of Boston Environment Department

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Table 24: Central Maintenance MTC Rebate Estimator Summary

Commonwealth Solar Non-Residential Solar Photovoltaic Calculator

Non-Residential: Commonwealth Solar Rebate Matrix ($/watt dc)

Incremental Capacity	1 to 25 kW (1,000 to 25,000 watts)	> 25 to 100 kW	> 100 kW to 200 kW	> 200 kW to 500 kW
Base Incentive ($/watt dc)	$3.25	$2.50	$2.00	$1.50
PLUS: Additions to Base				
MA-Manufactured Components	$0.25	$0.25	$0.25	$0.25
Public Building Adder	$0.50	$0.50	$0.25	$0.25

Non-Residential: Commonwealth Solar Rebate Calculator

Total PV Project Size (watts dc)	**31,954**
Total PV Project Size for Rebate Calculation (500 kW cap)	**31,954**
MA-manufactured components	YES
Public Building Adder	YES
Rebate ($)	**$ 122,600.50**
Rebate ($/watt dc) based on total project size	**$ 3.83678**
Key	
Entry Cells	
Calculation Cells (not for Entry)	

Click here for Financial Model

DATA ENTRY AND FINANCIAL SUMMARY

Key

Entry Cells	
Cells Draw Data from Another Worksheet	
Calculation Cells (Not for Entry)	

Select Taxable or Non-Taxable Entity	Non-Taxable	
Project and Customer Cost Assumptions		
Solar Photovoltaic System Size	31,954	Watts (DC STC)
Total System Cost/Watt	$ 7.00	$/Watt (DC STC)
Total System Cost	$ 223,678	
MTC Rebate Assumptions		
MTC Scenario A: Non-Taxable Rebate	$ 3.837	$/Watt (DC STC)
Scenario A Rebate	$ 122,601	
MTC Scenario B: Taxable Rebate	$ 3.925	$/Watt (DC STC)
Scenario B Rebate	$ 125,419	
Project Performance and Savings/ Cost Assumptions		
Annual Net Capacity Factor	13.1%	kW (DC STC) to kWh AC
Annual Production Degradation	0.50%	%
Project Life	25	Years
Electricity Revenue (Avoided Costs)	$ 0.15	$/kWh
Electricity Revenue (Avoided Costs) Annual Adjustor	5.0%	%
Renewable Energy Certificate (REC) Revenue	$ 0.03	$/kWh
REC Revenue Annual Adjustor	0.0%	%
REC Revenue Term	3	Years (must be equal to or less than project life)
Annual Operations and Maintenance Cost	$ 250	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.75	$/Watt (DC STC)
Inverter Life, Replace Every X Years	15	Year (must be equal to or less than project life)

Scenario Definitions

Scenario A: Non-Taxable Rebate - Assumes that the state rebate is non-taxable, but is subtracted from the cost basis for purposes of determin

Scenario B: Taxable Rebate - Assumes that the state rebate is taxable, but is not subtracted from the cost basis for purposes of determining ta

Both Scenarios assume that the project owner can use both federal and state tax benefits

Tax Assumptions

Federal Tax Rate	0%					
State Tax Rate	0%					
Effective Tax Rate	0%					
Federal Tax Credit	0%					
State Tax Deduction	0%					
5 Year Accelerated Depreciation Schedule (MACRS)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Financing Assumptions

% Financed w/ Cash	100%	
% Financed w/ Loan	0%	
Loan Interest Rate	8%	
Loan Period	20	Years (must be equal to or less than project life)
Scenario A Net Cost	$ 101,078	
Scenario A Loan	$ -	
Scenario B Net Cost	$ 98,259	
Scenario B Loan	$ -	
Customer Discount Rate	6%	

Solar Project Financial Analysis Summary	
Scenario A: Net Present Value	**$ (2,803)**
Scenario A: Simple Payback (100% Cash only)	**Year 14**
Scenario A: Estimated Return on Equity	**#DIV/0!**
Scenario A: Guess Return on Equity	50%
Scenario B: Net Present Value	**$ 16**
Scenario B: Simple Payback (100% Cash only)	**Year 14**
Scenario B: Estimated Return on Equity	**#DIV/0!**
Scenario B: Guess Return on Equity	50%

PRO FORMA AND PRODUCTION

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Annual Generation (kWh)		36,669	36,486	36,303	36,122	35,941	35,762

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 5,500	$ 5,747	$ 6,004	$ 6,272	$ 6,553	$ 6,846
REC Revenue		$ 1,100	$ 1,095	$ 1,089	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 6,600	$ 6,841	$ 7,093	$ 6,272	$ 6,553	$ 6,846
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 6,350	$ 6,584	$ 6,828	$ 5,999	$ 6,272	$ 6,556
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 6,350	$ 6,584	$ 6,828	$ 5,999	$ 6,272	$ 6,556
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 6,350	$ 6,584	$ 6,828	$ 5,999	$ 6,272	$ 6,556
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Net Income		**$ 6,350**	**$ 6,584**	**$ 6,828**	**$ 5,999**	**$ 6,272**	**$ 6,556**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 6,350	$ 6,584	$ 6,828	$ 5,999	$ 6,272	$ 6,556
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 6,350	$ 6,584	$ 6,828	$ 5,999	$ 6,272	$ 6,556
Cash From Investing							
Installed PV Cost	$ (101,078)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (101,078)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ (101,078)**	**$ 6,350**	**$ 6,584**	**$ 6,828**	**$ 5,999**	**$ 6,272**	**$ 6,556**
Cumulative Cash Flow	**$ (101,078)**	**$ (94,727)**	**$ (88,143)**	**$ (81,316)**	**$ (75,317)**	**$ (69,045)**	**$ (62,489)**

PRO FORMA AND PRODUCTION

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Annual Generation (kWh)	35,583	35,405	35,228	35,052	34,876	34,702	34,528

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 7,153	$ 7,473	$ 7,807	$ 8,156	$ 8,521	$ 8,903	$ 9,301
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 7,153	$ 7,473	$ 7,807	$ 8,156	$ 8,521	$ 8,903	$ 9,301
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 6,854	$ 7,165	$ 7,490	$ 7,830	$ 8,186	$ 8,557	$ 8,945
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 6,854	$ 7,165	$ 7,490	$ 7,830	$ 8,186	$ 8,557	$ 8,945
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 6,854	$ 7,165	$ 7,490	$ 7,830	$ 8,186	$ 8,557	$ 8,945
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 6,854**	**$ 7,165**	**$ 7,490**	**$ 7,830**	**$ 8,186**	**$ 8,557**	**$ 8,945**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 6,854	$ 7,165	$ 7,490	$ 7,830	$ 8,186	$ 8,557	$ 8,945
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 6,854	$ 7,165	$ 7,490	$ 7,830	$ 8,186	$ 8,557	$ 8,945
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 6,854**	**$ 7,165**	**$ 7,490**	**$ 7,830**	**$ 8,186**	**$ 8,557**	**$ 8,945**
Cumulative Cash Flow	**$ (55,635)**	**$ (48,469)**	**$ (40,979)**	**$ (33,149)**	**$ (24,963)**	**$ (16,406)**	**$ (7,462)**

PRO FORMA AND PRODUCTION

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Annual Generation (kWh)	34,356	34,184	34,013	$ 33,843	33,674	33,505	33,338

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 9,717	$ 10,152	$ 10,607	$ 11,081	$ 11,577	$ 12,095	$ 12,637
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 9,717	$ 10,152	$ 10,607	$ 11,081	$ 11,577	$ 12,095	$ 12,637
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (23,966)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (24,344)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 9,350	$ (14,191)	$ 10,217	$ 10,680	$ 11,164	$ 11,670	$ 12,198
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 9,350	$ (14,191)	$ 10,217	$ 10,680	$ 11,164	$ 11,670	$ 12,198
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 9,350	$ (14,191)	$ 10,217	$ 10,680	$ 11,164	$ 11,670	$ 12,198
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 9,350**	**$ (14,191)**	**$ 10,217**	**$ 10,680**	**$ 11,164**	**$ 11,670**	**$ 12,198**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 9,350	$ (14,191)	$ 10,217	$ 10,680	$ 11,164	$ 11,670	$ 12,198
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 9,350	$ (14,191)	$ 10,217	$ 10,680	$ 11,164	$ 11,670	$ 12,198
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 9,350**	**$ (14,191)**	**$ 10,217**	**$ 10,680**	**$ 11,164**	**$ 11,670**	**$ 12,198**
Cumulative Cash Flow	**$ 1,889**	**$ (12,303)**	**$ (2,085)**	**$ 8,595**	**$ 19,759**	**$ 31,428**	**$ 43,626**

PRO FORMA AND PRODUCTION

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Annual Generation (kWh)	33,171	33,005	32,840	32,676	32,513

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 21	Year 22	Year 23	Year 24	Year 25
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 13,202	$ 13,793	$ 14,410	$ 15,055	$ 15,729
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 13,202	$ 13,793	$ 14,410	$ 15,055	$ 15,729
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 12,750	$ 13,328	$ 13,931	$ 14,561	$ 15,220
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 12,750	$ 13,328	$ 13,931	$ 14,561	$ 15,220
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 12,750	$ 13,328	$ 13,931	$ 14,561	$ 15,220
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 12,750**	**$ 13,328**	**$ 13,931**	**$ 14,561**	**$ 15,220**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 12,750	$ 13,328	$ 13,931	$ 14,561	$ 15,220
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 12,750	$ 13,328	$ 13,931	$ 14,561	$ 15,220
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 12,750**	**$ 13,328**	**$ 13,931**	**$ 14,561**	**$ 15,220**
Cumulative Cash Flow	**$ 56,377**	**$ 69,705**	**$ 83,636**	**$ 98,197**	**$ 113,417**

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 5,500	$ 5,747	$ 6,004	$ 6,272	$ 6,553	$ 6,846
REC Revenue		$ 1,100	$ 1,095	$ 1,089	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 6,600	$ 6,841	$ 7,093	$ 6,272	$ 6,553	$ 6,846
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 6,350	$ 6,584	$ 6,828	$ 5,999	$ 6,272	$ 6,556
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 6,350	$ 6,584	$ 6,828	$ 5,999	$ 6,272	$ 6,556
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 6,350	$ 6,584	$ 6,828	$ 5,999	$ 6,272	$ 6,556
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate		$ -					
Net Income		**$ 6,350**	**$ 6,584**	**$ 6,828**	**$ 5,999**	**$ 6,272**	**$ 6,556**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 6,350	$ 6,584	$ 6,828	$ 5,999	$ 6,272	$ 6,556
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 6,350	$ 6,584	$ 6,828	$ 5,999	$ 6,272	$ 6,556
Cash From Investing							
Installed PV Cost	$ (98,259)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (98,259)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ (98,259)**	**$ 6,350**	**$ 6,584**	**$ 6,828**	**$ 5,999**	**$ 6,272**	**$ 6,556**
Cumulative Cash Flow	**$ (98,259)**	**$ (91,908)**	**$ (85,325)**	**$ (78,497)**	**$ (72,498)**	**$ (66,226)**	**$ (59,670)**

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 7,153	$ 7,473	$ 7,807	$ 8,156	$ 8,521	$ 8,903	$ 9,301
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 7,153	$ 7,473	$ 7,807	$ 8,156	$ 8,521	$ 8,903	$ 9,301
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 6,854	$ 7,165	$ 7,490	$ 7,830	$ 8,186	$ 8,557	$ 8,945
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 6,854	$ 7,165	$ 7,490	$ 7,830	$ 8,186	$ 8,557	$ 8,945
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 6,854	$ 7,165	$ 7,490	$ 7,830	$ 8,186	$ 8,557	$ 8,945
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 6,854**	**$ 7,165**	**$ 7,490**	**$ 7,830**	**$ 8,186**	**$ 8,557**	**$ 8,945**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 6,854	$ 7,165	$ 7,490	$ 7,830	$ 8,186	$ 8,557	$ 8,945
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 6,854	$ 7,165	$ 7,490	$ 7,830	$ 8,186	$ 8,557	$ 8,945
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 6,854**	**$ 7,165**	**$ 7,490**	**$ 7,830**	**$ 8,186**	**$ 8,557**	**$ 8,945**
Cumulative Cash Flow	**$ (52,816)**	**$ (45,650)**	**$ (38,160)**	**$ (30,330)**	**$ (22,144)**	**$ (13,587)**	**$ (4,643)**

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 9,717	$ 10,152	$ 10,607	$ 11,081	$ 11,577	$ 12,095	$ 12,637
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 9,717	$ 10,152	$ 10,607	$ 11,081	$ 11,577	$ 12,095	$ 12,637
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (23,966)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (24,344)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 9,350	$ (14,191)	$ 10,217	$ 10,680	$ 11,164	$ 11,670	$ 12,198
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 9,350	$ (14,191)	$ 10,217	$ 10,680	$ 11,164	$ 11,670	$ 12,198
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 9,350	$ (14,191)	$ 10,217	$ 10,680	$ 11,164	$ 11,670	$ 12,198
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 9,350**	**$ (14,191)**	**$ 10,217**	**$ 10,680**	**$ 11,164**	**$ 11,670**	**$ 12,198**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 9,350	$ (14,191)	$ 10,217	$ 10,680	$ 11,164	$ 11,670	$ 12,198
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 9,350	$ (14,191)	$ 10,217	$ 10,680	$ 11,164	$ 11,670	$ 12,198
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 9,350**	**$ (14,191)**	**$ 10,217**	**$ 10,680**	**$ 11,164**	**$ 11,670**	**$ 12,198**
Cumulative Cash Flow	**$ 4,708**	**$ (9,484)**	**$ 734**	**$ 11,414**	**$ 22,578**	**$ 34,247**	**$ 46,445**

Project Output	**Year 21**	**Year 22**	**Year 23**	**Year 24**	**Year 25**
Scenario B: Taxable Rebate; Pro Forma Project Economics					
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 13,202	$ 13,793	$ 14,410	$ 15,055	$ 15,729
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 13,202	$ 13,793	$ 14,410	$ 15,055	$ 15,729
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 12,750	$ 13,328	$ 13,931	$ 14,561	$ 15,220
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 12,750	$ 13,328	$ 13,931	$ 14,561	$ 15,220
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 12,750	$ 13,328	$ 13,931	$ 14,561	$ 15,220
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate					
Net Income	**$ 12,750**	**$ 13,328**	**$ 13,931**	**$ 14,561**	**$ 15,220**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 12,750	$ 13,328	$ 13,931	$ 14,561	$ 15,220
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 12,750	$ 13,328	$ 13,931	$ 14,561	$ 15,220
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 12,750**	**$ 13,328**	**$ 13,931**	**$ 14,561**	**$ 15,220**
Cumulative Cash Flow	**$ 59,196**	**$ 72,524**	**$ 86,455**	**$ 101,016**	**$ 116,236**

CURLEY COMMUNITY CENTER

Table 25: Curley Community Center PV Profile

Building	
Building Name	Curley L Street Community Center
Building Address	1663 Columbia Road
City Department	Boston Centers for Youth and Families
Number of floors	
Square footage (if known)	
Fuel Type(s)	Natural Gas
Contact Information	
Facilities Manager	Pat McDonough
Phone	617-635-5104
Email	
Electrical Connection	
Electric Utility Company	
Floor Plan showing Electrical room	Yes / No
Roof Details	
Roof slope/angle (Flat = 0°)	Flat
Roof Orientation (S, SE, SW, etc.)	N/A
Roof Size – Square Feet	73035 sq ft
Roof Condition: poor, fair, good, excellent, new	Good
Roof Type (asphalt, shingles, rubber membrane, etc.)	Rubber
Expected life of roof (years)	
Equipment/obstructions on the roof	Platforms with exhaust vents
Detailed Roof Drawings available	Yes / No

Table 26: Curley Community Center Summary of Findings

Summary of Findings	
Suited for Solar Water Heating?	Yes
Site Efficiency	99.03%
Area of roof available for panel installation	29,214 sq ft
Maximum number of panels that can be installed	1,000
DC Output of maximum number of panels	35,916 W
Net Capacity Factor (%)	14.73%
Cost of Installation:	

Figure 31: Curley Community Center Solar Pathfinder Report

WPI Solar Team and Solar Boston Site Report

Report Name	Curly Community Center
Report Date	4/2/2008 1:55:19 PM
Declination	-15d 13m
Location	BOSTON, MA, Zipcode: 02127
Lat/Long	42.329 / -71.02
Weather Station	BOSTON, MA, Elevation: 5 m
Site distance	2.69 miles
Array Type	Fixed
Tilt Angle	42.33 deg
Ideal Tilt Angle	42.33 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Make	Evergreen Solar
Panel Model	ES-195-RL
Panel Count	1000
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	Custom
Layout Point Count	3

Notes: [None]
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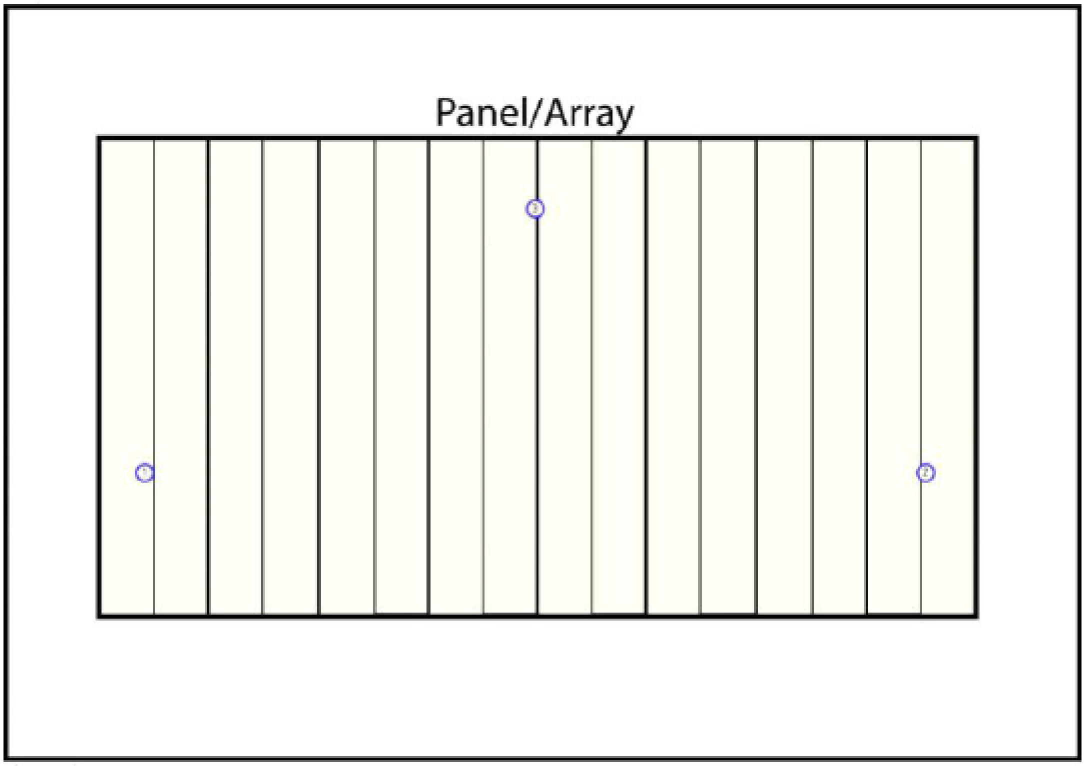
WPI Solar Team and Solar Boston System Picture Layout

Layout Type Custom
Layout Point Count 3



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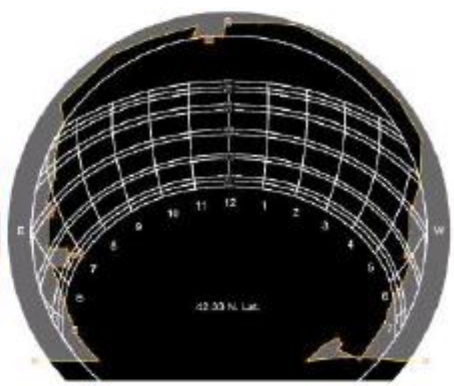
WPI Solar Team and Solar E 1 st
Solar Site Analysis Report

Image File curley1.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.33	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.33 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	99.00%	3.33	16973.00	16900.16
February	99.00%	4.32	19875.00	19771.59
March	99.00%	4.74	23261.00	23223.51
April	99.00%	4.86	22632.00	22563.49
May	98.00%	5.22	24177.00	23949.85
June	99.00%	5.34	22914.00	22866.33
July	98.00%	5.51	24461.00	24322.08
August	98.00%	5.56	24815.00	24696.92
September	98.00%	5.01	22387.00	22153.55
October	98.00%	4.54	21727.00	21407.68
November	99.00%	3.09	14712.00	14569.98
December	99.00%	2.94	14701.00	14585.00
Totals	**98.49%**	**54.46**	**252635.0**	**251010.13**
	Unweighted Yearly Avg	**Effect: 98.44% Sun Hrs: 4.54**		

Notes: [None]



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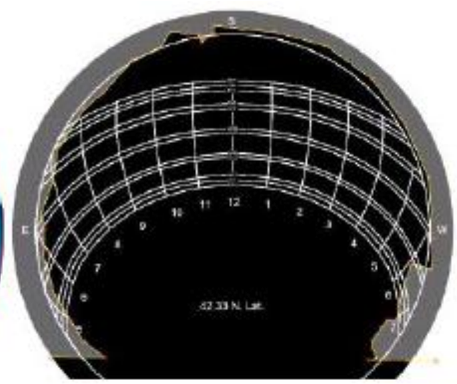
WPI Solar Team and Solar E 2 st
Solar Site Analysis Report

Image File curley2.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.33	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.33 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	99.00%	3.32	16973.00	16866.24
February	99.00%	4.34	19875.00	19823.30
March	100.00%	4.78	23261.00	23251.61
April	100.00%	4.90	22632.00	22631.25
May	99.00%	5.30	24177.00	24174.36
June	99.00%	5.39	22914.00	22911.36
July	99.00%	5.57	24461.00	24458.24
August	100.00%	5.62	24815.00	24814.32
September	99.00%	5.10	22387.00	22329.10
October	98.00%	4.58	21727.00	21595.14
November	99.00%	3.09	14712.00	14569.98
December	98.00%	2.92	14701.00	14504.50
Totals	**99.15%**	**54.89**	**252635.0**	**251929.4**
	Unweighted Yearly Avg	**Effect: 99.23% Sun Hrs: 4.57**		

Notes: [None]



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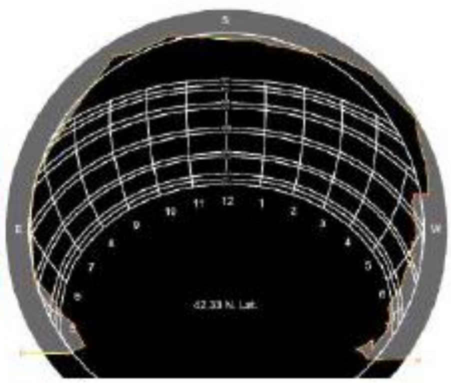
WPI Solar Team and Solar E3st
Solar Site Analysis Report

Image File curley 3.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.33	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.33 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	99.00%	3.32	16973.00	16883.46
February	100.00%	4.36	19875.00	19875.00
March	100.00%	4.79	23261.00	23257.87
April	100.00%	4.91	22632.00	22631.75
May	99.00%	5.30	24177.00	24173.83
June	99.00%	5.38	22914.00	22910.60
July	99.00%	5.57	24461.00	24458.34
August	100.00%	5.63	24815.00	24814.68
September	100.00%	5.11	22387.00	22377.13
October	99.00%	4.61	21727.00	21670.53
November	99.00%	3.10	14712.00	14588.00
December	98.00%	2.92	14701.00	14527.50
Totals	**99.35%**	**55.00**	**252635.0**	**252168.69**
	Unweighted Yearly Avg	**Effect: 99.42% Sun Hrs: 4.58**		

Notes: [None]



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WPI Solar Team and Solar Bost Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.33	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.33 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	99.00%	3.32	16973.00	16883.29
February	99.33%	4.34	19875.00	19823.30
March	99.67%	4.77	23261.00	23244.33
April	99.67%	4.89	22632.00	22608.83
May	98.67%	5.27	24177.00	24099.35
June	99.00%	5.37	22914.00	22896.10
July	98.67%	5.55	24461.00	24412.89
August	99.33%	5.60	24815.00	24775.31
September	99.00%	5.07	22387.00	22286.59
October	98.33%	4.58	21727.00	21557.78
November	99.00%	3.09	14712.00	14575.99
December	98.33%	2.93	14701.00	14539.00
Totals	**99.00%**	**54.46**	**252635.0**	**251702.74**
	Unweighted Yearly Avg	**Effect: 99.03% Sun Hrs: 4.57**		

Notes: [None]
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Table 27: Curley Community Center MTC Rebate Estimator Summary

Commonwealth Solar Non-Residential Solar Photovoltaic Calculator

Non-Residential: Commonwealth Solar Rebate Matrix ($/watt dc)				
Incremental Capacity	**1 to 25 kW** (1,000 to 25,000 watts)	**> 25 to 100 kW**	**> 100 kW to 200 kW**	**> 200 kW to 500 kW**
Base Incentive ($/watt dc)	$3.25	$2.50	$2.00	$1.50
PLUS: Additions to Base				
MA-Manufactured Components	$0.25	$0.25	$0.25	$0.25
Public Building Adder	$0.50	$0.50	$0.25	$0.25

Non-Residential: Commonwealth Solar Rebate Calculator	
Total PV Project Size (watts dc)	**35,916**
Total PV Project Size for Rebate Calculation (500 kW cap)	**35,916**
MA-manufactured components	YES
Public Building Adder	YES
Rebate ($)	**$ 135,477.00**
Rebate ($/watt dc) based on total project size	**$ 3.77205**
Key	
Entry Cells	
Calculation Cells (not for Entry)	

Click here for Financial Model

DATA ENTRY AND FINANCIAL SUMMARY

Key		
Entry Cells		
Cells Draw Data from Another Worksheet		
Calculation Cells (Not for Entry)		
Select Taxable or Non-Taxable Entity	Non-Taxable	
Project and Customer Cost Assumptions		
Solar Photovoltaic System Size	35,916	Watts (DC STC
Total System Cost/Watt	$ 7.00	$/Watt (DC STC
Total System Cost	$ 251,412	
MTC Rebate Assumptions		
MTC Scenario A: Non-Taxable Rebate	$ 3.772	$/Watt (DC STC
Scenario A Rebate	$ 135,477	
MTC Scenario B: Taxable Rebate	$ 3.480	$/Watt (DC STC
Scenario B Rebate	$ 124,988	
Project Performance and Savings/ Cost Assumptions		
Annual Net Capacity Factor	14.7%	kW (DC STC) to
Annual Production Degradation	0.50%	%
Project Life	25	Years
Electricity Revenue (Avoided Costs)	$ 0.15	$/kWh
Electricity Revenue (Avoided Costs) Annual Adjustor	5.0%	%
Renewable Energy Certificate (REC) Revenue	$ 0.03	$/kWh
REC Revenue Annual Adjustor	0.0%	%
REC Revenue Term	3	Years (must be
Annual Operations and Maintenance Cost	$ 250	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.75	$/Watt (DC STC
Inverter Life, Replace Every X Years	15	Year (must be e

Scenario Definitions

Scenario A: Non-Taxable Rebate - Assumes that the state rebate is non-taxable, but is subtracted from the cost basis for p

Scenario B: Taxable Rebate - Assumes that the state rebate is taxable, but is not subtracted from the cost basis for purpo

Both Scenarios assume that the project owner can use both federal and state tax benefits

Tax Assumptions

Federal Tax Rate	0%				
State Tax Rate	0%				
Effective Tax Rate	0%				
Federal Tax Credit	0%				
State Tax Deduction	0%				
5 Year Accelerated Depreciation Schedule (MACRS)	0.00%	0.00%	0.00%	0.00%	0.00%

Financing Assumptions

% Financed w/ Cash	100%	
% Financed w/ Loan	0%	
Loan Interest Rate	8%	
Loan Period	20	Years (must be equal to or less than project life)
Scenario A Net Cost	$ 115,935	
Scenario A Loan	$ -	
Scenario B Net Cost	$ 126,424	
Scenario B Loan	$ -	
Customer Discount Rate	6%	

Solar Project Financial Analysis Summary	
Scenario A: Net Present Value	**$ 10,503**
Scenario A: Simple Payback (100% Cash only)	**Year 13**
Scenario A: Estimated Return on Equity	**#DIV/0!**
Scenario A: Guess Return on Equity	50%
Scenario B: Net Present Value	**$ 14**
Scenario B: Simple Payback (100% Cash only)	**Year 14**
Scenario B: Estimated Return on Equity	**#DIV/0!**
Scenario B: Guess Return on Equity	50%

PRO FORMA AND PRODUCTION

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Annual Generation (kWh)		46,250	46,019	45,788	45,559	45,332	45,105

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 6,937	$ 7,248	$ 7,572	$ 7,911	$ 8,265	$ 8,635
REC Revenue		$ 1,387	$ 1,381	$ 1,374	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 8,325	$ 8,628	$ 8,946	$ 7,911	$ 8,265	$ 8,635
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 8,075	$ 8,371	$ 8,681	$ 7,638	$ 7,984	$ 8,345
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 8,075	$ 8,371	$ 8,681	$ 7,638	$ 7,984	$ 8,345
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 8,075	$ 8,371	$ 8,681	$ 7,638	$ 7,984	$ 8,345
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Net Income		**$ 8,075**	**$ 8,371**	**$ 8,681**	**$ 7,638**	**$ 7,984**	**$ 8,345**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 8,075	$ 8,371	$ 8,681	$ 7,638	$ 7,984	$ 8,345
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 8,075	$ 8,371	$ 8,681	$ 7,638	$ 7,984	$ 8,345
Cash From Investing							
Installed PV Cost	$ (115,935)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (115,935)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ (115,935)**	**$ 8,075**	**$ 8,371**	**$ 8,681**	**$ 7,638**	**$ 7,984**	**$ 8,345**
Cumulative Cash Flow	**$ (115,935)**	**$ (107,860)**	**$ (99,489)**	**$ (90,808)**	**$ (83,170)**	**$ (75,187)**	**$ (66,842)**

PRO FORMA AND PRODUCTION

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Annual Generation (kWh)	44,879	44,655	44,432	44,210	43,989	43,769	43,550

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 9,021	$ 9,425	$ 9,847	$ 10,288	$ 10,748	$ 11,229	$ 11,731
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 9,021	$ 9,425	$ 9,847	$ 10,288	$ 10,748	$ 11,229	$ 11,731
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 8,723	$ 9,118	$ 9,530	$ 9,961	$ 10,412	$ 10,883	$ 11,375
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 8,723	$ 9,118	$ 9,530	$ 9,961	$ 10,412	$ 10,883	$ 11,375
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 8,723	$ 9,118	$ 9,530	$ 9,961	$ 10,412	$ 10,883	$ 11,375
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 8,723**	**$ 9,118**	**$ 9,530**	**$ 9,961**	**$ 10,412**	**$ 10,883**	**$ 11,375**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 8,723	$ 9,118	$ 9,530	$ 9,961	$ 10,412	$ 10,883	$ 11,375
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 8,723	$ 9,118	$ 9,530	$ 9,961	$ 10,412	$ 10,883	$ 11,375
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 8,723**	**$ 9,118**	**$ 9,530**	**$ 9,961**	**$ 10,412**	**$ 10,883**	**$ 11,375**
Cumulative Cash Flow	**$ (58,119)**	**$ (49,001)**	**$ (39,471)**	**$ (29,509)**	**$ (19,097)**	**$ (8,215)**	**$ 3,160**

PRO FORMA AND PRODUCTION

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Annual Generation (kWh)	43,332	43,115	42,900	$ 42,685	42,472	42,260	42,048

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 12,256	$ 12,805	$ 13,378	$ 13,977	$ 14,602	$ 15,255	$ 15,938
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 12,256	$ 12,805	$ 13,378	$ 13,977	$ 14,602	$ 15,255	$ 15,938
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (26,937)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (27,315)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 11,889	$ (14,510)	$ 12,988	$ 13,575	$ 14,189	$ 14,830	$ 15,500
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 11,889	$ (14,510)	$ 12,988	$ 13,575	$ 14,189	$ 14,830	$ 15,500
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 11,889	$ (14,510)	$ 12,988	$ 13,575	$ 14,189	$ 14,830	$ 15,500
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 11,889**	**$ (14,510)**	**$ 12,988**	**$ 13,575**	**$ 14,189**	**$ 14,830**	**$ 15,500**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 11,889	$ (14,510)	$ 12,988	$ 13,575	$ 14,189	$ 14,830	$ 15,500
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 11,889	$ (14,510)	$ 12,988	$ 13,575	$ 14,189	$ 14,830	$ 15,500
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 11,889**	**$ (14,510)**	**$ 12,988**	**$ 13,575**	**$ 14,189**	**$ 14,830**	**$ 15,500**
Cumulative Cash Flow	**$ 15,050**	**$ 339**	**$ 13,528**	**$ 27,103**	**$ 41,292**	**$ 56,121**	**$ 71,621**

PRO FORMA AND PRODUCTION

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Annual Generation (kWh)	41,838	41,629	41,421	41,214	41,008

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

INCOME STATEMENT	Year 21	Year 22	Year 23	Year 24	Year 25
Electricity Revenue (Avoided Cost)	$ 16,651	$ 17,396	$ 18,175	$ 18,988	$ 19,838
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 16,651	$ 17,396	$ 18,175	$ 18,988	$ 19,838
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 16,200	$ 16,931	$ 17,696	$ 18,495	$ 19,330
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 16,200	$ 16,931	$ 17,696	$ 18,495	$ 19,330
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 16,200	$ 16,931	$ 17,696	$ 18,495	$ 19,330
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 16,200**	**$ 16,931**	**$ 17,696**	**$ 18,495**	**$ 19,330**

CASH FLOW STATEMENT	Year 21	Year 22	Year 23	Year 24	Year 25
Cash From Operations					
Net Income	$ 16,200	$ 16,931	$ 17,696	$ 18,495	$ 19,330
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 16,200	$ 16,931	$ 17,696	$ 18,495	$ 19,330
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 16,200**	**$ 16,931**	**$ 17,696**	**$ 18,495**	**$ 19,330**
Cumulative Cash Flow	**$ 87,821**	**$ 104,752**	**$ 122,448**	**$ 140,943**	**$ 160,273**

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 6,937	$ 7,248	$ 7,572	$ 7,911	$ 8,265	$ 8,635
REC Revenue		$ 1,387	$ 1,381	$ 1,374	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 8,325	$ 8,628	$ 8,946	$ 7,911	$ 8,265	$ 8,635
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 8,075	$ 8,371	$ 8,681	$ 7,638	$ 7,984	$ 8,345
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 8,075	$ 8,371	$ 8,681	$ 7,638	$ 7,984	$ 8,345
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 8,075	$ 8,371	$ 8,681	$ 7,638	$ 7,984	$ 8,345
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate		$ -					
Net Income		**$ 8,075**	**$ 8,371**	**$ 8,681**	**$ 7,638**	**$ 7,984**	**$ 8,345**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 8,075	$ 8,371	$ 8,681	$ 7,638	$ 7,984	$ 8,345
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 8,075	$ 8,371	$ 8,681	$ 7,638	$ 7,984	$ 8,345
Cash From Investing							
Installed PV Cost	$ (126,424)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (126,424)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ (126,424)**	**$ 8,075**	**$ 8,371**	**$ 8,681**	**$ 7,638**	**$ 7,984**	**$ 8,345**
Cumulative Cash Flow	**$ (126,424)**	**$ (118,349)**	**$ (109,978)**	**$ (101,298)**	**$ (93,660)**	**$ (85,676)**	**$ (77,331)**

Project Output	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 9,021	$ 9,425	$ 9,847	$ 10,288	$ 10,748	$ 11,229	$ 11,731
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 9,021	$ 9,425	$ 9,847	$ 10,288	$ 10,748	$ 11,229	$ 11,731
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 8,723	$ 9,118	$ 9,530	$ 9,961	$ 10,412	$ 10,883	$ 11,375
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 8,723	$ 9,118	$ 9,530	$ 9,961	$ 10,412	$ 10,883	$ 11,375
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 8,723	$ 9,118	$ 9,530	$ 9,961	$ 10,412	$ 10,883	$ 11,375
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 8,723**	**$ 9,118**	**$ 9,530**	**$ 9,961**	**$ 10,412**	**$ 10,883**	**$ 11,375**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 8,723	$ 9,118	$ 9,530	$ 9,961	$ 10,412	$ 10,883	$ 11,375
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 8,723	$ 9,118	$ 9,530	$ 9,961	$ 10,412	$ 10,883	$ 11,375
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 8,723**	**$ 9,118**	**$ 9,530**	**$ 9,961**	**$ 10,412**	**$ 10,883**	**$ 11,375**
Cumulative Cash Flow	**$ (68,608)**	**$ (59,490)**	**$ (49,960)**	**$ (39,999)**	**$ (29,587)**	**$ (18,704)**	**$ (7,329)**

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 12,256	$ 12,805	$ 13,378	$ 13,977	$ 14,602	$ 15,255	$ 15,938
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 12,256	$ 12,805	$ 13,378	$ 13,977	$ 14,602	$ 15,255	$ 15,938
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (26,937)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (27,315)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 11,889	$ (14,510)	$ 12,988	$ 13,575	$ 14,189	$ 14,830	$ 15,500
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 11,889	$ (14,510)	$ 12,988	$ 13,575	$ 14,189	$ 14,830	$ 15,500
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 11,889	$ (14,510)	$ 12,988	$ 13,575	$ 14,189	$ 14,830	$ 15,500
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 11,889**	**$ (14,510)**	**$ 12,988**	**$ 13,575**	**$ 14,189**	**$ 14,830**	**$ 15,500**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 11,889	$ (14,510)	$ 12,988	$ 13,575	$ 14,189	$ 14,830	$ 15,500
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 11,889	$ (14,510)	$ 12,988	$ 13,575	$ 14,189	$ 14,830	$ 15,500
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 11,889**	**$ (14,510)**	**$ 12,988**	**$ 13,575**	**$ 14,189**	**$ 14,830**	**$ 15,500**
Cumulative Cash Flow	**$ 4,560**	**$ (9,950)**	**$ 3,038**	**$ 16,614**	**$ 30,802**	**$ 45,632**	**$ 61,132**

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Scenario B: Taxable Rebate; Pro Forma Project Economics					
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 16,651	$ 17,396	$ 18,175	$ 18,988	$ 19,838
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 16,651	$ 17,396	$ 18,175	$ 18,988	$ 19,838
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 16,200	$ 16,931	$ 17,696	$ 18,495	$ 19,330
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 16,200	$ 16,931	$ 17,696	$ 18,495	$ 19,330
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 16,200	$ 16,931	$ 17,696	$ 18,495	$ 19,330
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate					
Net Income	**$ 16,200**	**$ 16,931**	**$ 17,696**	**$ 18,495**	**$ 19,330**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 16,200	$ 16,931	$ 17,696	$ 18,495	$ 19,330
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 16,200	$ 16,931	$ 17,696	$ 18,495	$ 19,330
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 16,200**	**$ 16,931**	**$ 17,696**	**$ 18,495**	**$ 19,330**
Cumulative Cash Flow	**$ 77,332**	**$ 94,263**	**$ 111,959**	**$ 130,454**	**$ 149,784**

TOBIN COMMUNITY CENTER

Table 28: Tobin Community Center PV Profile

Building	
Building Name	Tobin Community Center
Building Address	1481 Tremont Street
City Department	Boston Centers for Youth and Families
Number of floors	4
Square footage (if known)	
Fuel Type(s)	Natural Gas
Contact Information	
Facilities Manager	Pat McDonough
Phone	781-302-4835
Email	
Electrical Connection	
Electric Utility Company	
Floor Plan showing Electrical room	Yes / No
Roof Details	
Roof slope/angle (Flat = 0°)	0°
Roof Orientation (S, SE, SW, etc.)	N/A
Roof Size – Square Feet	23246.93 sq ft
Roof Condition: poor, fair, good, excellent, new	Good
Roof Type (asphalt, shingles, rubber membrane, etc.)	Asphalt
Expected life of roof (years)	
Equipment/obstructions on the roof	No
Detailed Roof Drawings available	Yes / No

Table 29: Tobin Community Center Summary of Findings

Summary of Findings	
Suited for Solar Water Heating?	Yes
Site Efficiency	95.19%
Area of roof available for panel installation	9,298 sq ft
Maximum number of panels that can be installed	579
DC Output of maximum number of panels	18,045 W
Net Capacity Factor (%)	12.8 %
Cost of Installation:	

Figure 32: Tobin Community Center Solar Pathfinder Report

WPI SolarBoston

WPI Solar Team and Solar Boston Site Report

Report Name	Tobin Community Center
Report Date	4/2/2008 1:29:39 PM
Declination	-15d 11m
Location	BOSTON, MA, Zipcode: 02120
Lat/Long	42.332 / -71.096
Weather Station	Boston, MA, Elevation: 6 m
Site distance	1.94 miles
Array Type	Fixed
Tilt Angle	42.33 deg
Ideal Tilt Angle	42.33 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Make	Evergreen Solar
Panel Model	ES-195-RL
Panel Count	579
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	FourCorner
Layout Point Count	4

Notes: [None]

Report generated by SolarPathfinder Assistant Version 3.0.7.0. http://www.solarpathfinder.com

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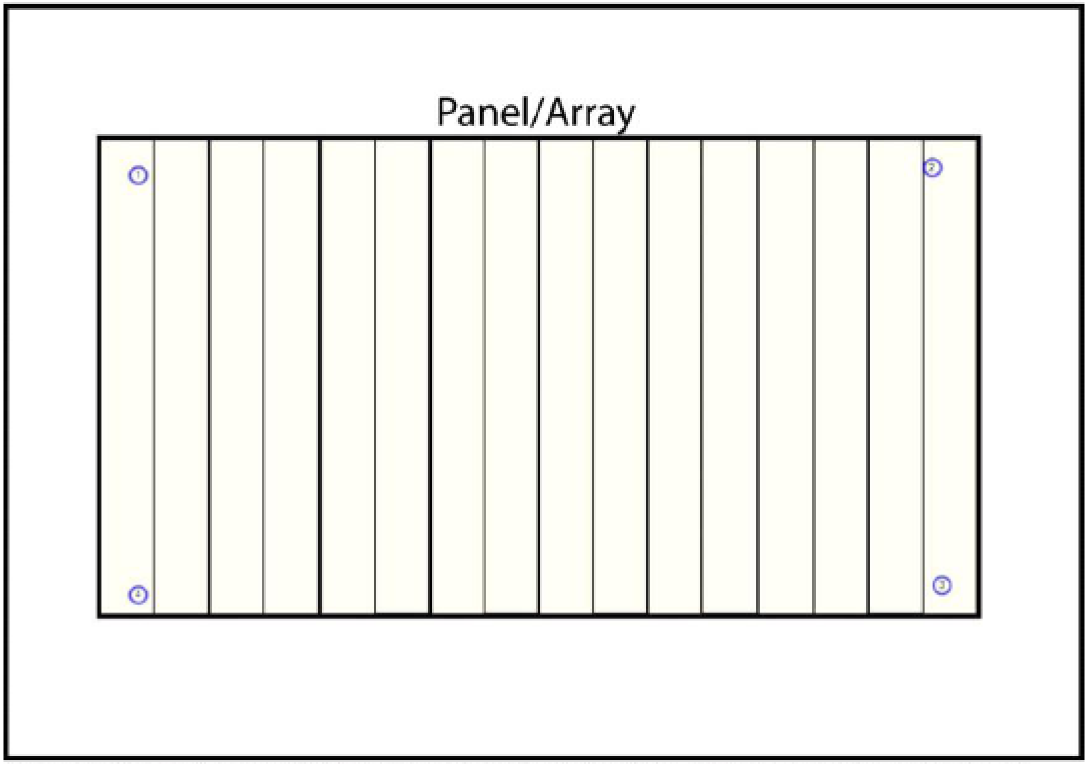
WPI Solar Team and Solar Boston System Picture Layout

Layout Type Four Corners
Layout Point Count 4



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WPI Solar Team and Solar E1st
Solar Site Analysis Report

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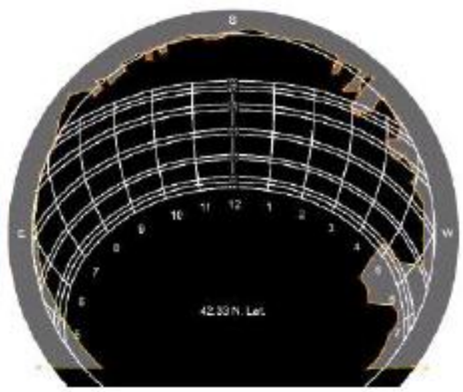
Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.33	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.33 $KWH/m^2/day$	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	98.00%	2.43	7188.00	7057.66
February	97.00%	3.22	8482.00	8285.67
March	100.00%	4.18	11823.00	11818.10
April	100.00%	4.49	11759.00	11759.00
May	98.00%	5.02	13419.00	13343.19
June	96.00%	5.48	14046.00	13715.40
July	97.00%	5.18	13534.00	13264.26
August	100.00%	5.04	12880.00	12880.00
September	100.00%	5.13	13070.00	13054.79
October	99.00%	3.83	10279.00	10247.64
November	98.00%	2.70	7365.00	7287.69
December	97.00%	2.26	6744.00	6566.15
Totals	**98.24%**	**48.96**	**130589.0**	**129279.55**
	Unweighted Yearly Avg	**Effect: 98.25% Sun Hrs: 4.08**		

Notes: [None]



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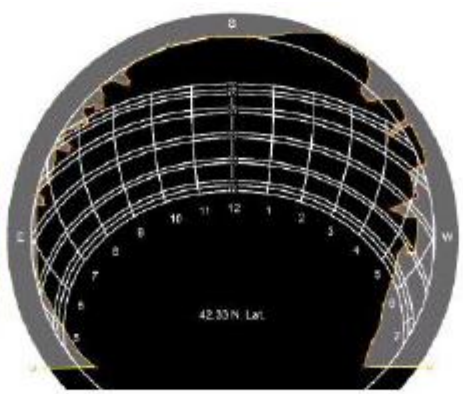
WPI Solar Team and Solar E 4 st
Solar Site Analysis Report

Image File tobin2.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.33	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.33 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	100.00%	2.47	7188.00	7181.21
February	99.00%	3.29	8482.00	8446.96
March	99.00%	4.16	11823.00	11800.86
April	99.00%	4.48	11759.00	11749.19
May	98.00%	5.02	13419.00	13338.96
June	98.00%	5.62	14046.00	13978.29
July	99.00%	5.29	13534.00	13471.88
August	99.00%	5.00	12880.00	12833.78
September	99.00%	5.08	13070.00	13005.79
October	99.00%	3.82	10279.00	10226.66
November	99.00%	2.72	7365.00	7318.44
December	98.00%	2.29	6744.00	6658.81
Totals	**98.88%**	**49.25**	**130589.0**	**130010.84**
	Unweighted Yearly Avg	**Effect: 98.83% Sun Hrs: 4.10**		

Notes: [None]



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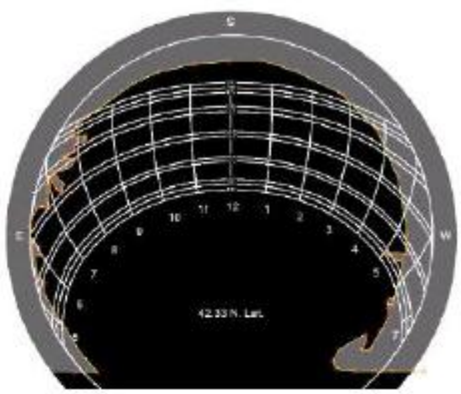
WPI Solar Team and Solar E3st
Solar Site Analysis Report

Image File tobin3.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.33	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.33 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	94.00%	2.33	7188.00	6853.46
February	96.00%	3.17	8482.00	8204.19
March	99.00%	4.14	11823.00	11738.23
April	99.00%	4.46	11759.00	11737.05
May	98.00%	5.03	13419.00	13345.43
June	99.00%	5.65	14046.00	14028.57
July	99.00%	5.32	13534.00	13512.72
August	99.00%	4.99	12880.00	12830.37
September	99.00%	5.08	13070.00	13003.40
October	95.00%	3.68	10279.00	9899.26
November	95.00%	2.61	7365.00	7116.85
December	92.00%	2.14	6744.00	6276.60
Totals	**96.95%**	**48.61**	**130589.0**	**128546.13**
	Unweighted Yearly Avg	**Effect: 97.54% Sun Hrs: 4.05**		

Notes: [None]



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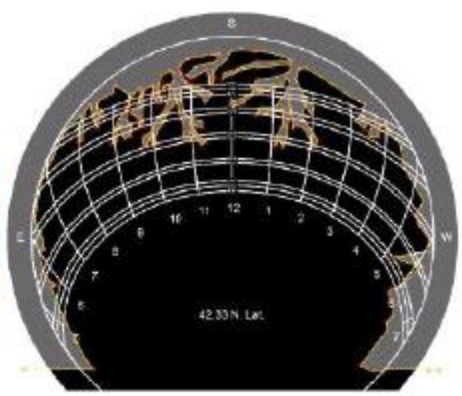
WPI Solar Team and Solar E2st Solar Site Analysis Report

Image File tobin4.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.33	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.33 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	69.00%	1.72	7188.00	5032.32
February	76.00%	2.52	8482.00	6452.04
March	90.00%	3.78	11823.00	10695.50
April	99.00%	4.48	11759.00	11751.16
May	99.00%	5.06	13419.00	13408.72
June	99.00%	5.64	14046.00	14023.09
July	99.00%	5.32	13534.00	13524.66
August	99.00%	5.01	12880.00	12850.22
September	94.00%	4.84	13070.00	12332.38
October	81.00%	3.13	10279.00	8359.08
November	70.00%	1.92	7365.00	5195.48
December	64.00%	1.50	6744.00	4376.66
Totals	**86.68%**	**44.92**	**130589.0**	**118001.3**
	Unweighted Yearly Avg	**Effect: 90.13% Sun Hrs: 3.74**		

Notes: [None]



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WPI Solar Team and Solar Bost Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.33	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.33 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	90.25%	2.24	7188.00	6531.16
February	92.00%	3.05	8482.00	7847.22
March	97.00%	4.07	11823.00	11513.17
April	99.25%	4.48	11759.00	11749.10
May	98.25%	5.03	13419.00	13359.08
June	98.00%	5.60	14046.00	13936.34
July	98.50%	5.28	13534.00	13443.38
August	99.25%	5.01	12880.00	12848.59
September	98.00%	5.03	13070.00	12849.09
October	93.50%	3.62	10279.00	9683.16
November	90.50%	2.49	7365.00	6729.62
December	87.75%	2.05	6744.00	5969.56
Totals	**95.19%**	**48.96**	**130589.0**	**126459.46**
	Unweighted Yearly Avg	**Effect: 96.19% Sun Hrs: 3.99**		

Notes: [None]

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Table 30: Tobin Community Center MTC Rebate Estimator Summary

Commonwealth Solar Non-Residential Solar Photovoltaic Calculator

Non-Residential: Commonwealth Solar Rebate Matrix ($/watt dc)				
Incremental Capacity	**1 to 25 kW** (1,000 to 25,000 watts)	**> 25 to 100 kW**	**> 100 kW to 200 kW**	**> 200 kW to 500 kW**
Base Incentive ($/watt dc)	$3.25	$2.50	$2.00	$1.50
PLUS: Additions to Base				
MA-Manufactured Components	$0.25	$0.25	$0.25	$0.25
Public Building Adder	$0.50	$0.50	$0.25	$0.25

Non-Residential: Commonwealth Solar Rebate Calculator	
Total PV Project Size (watts dc)	**10,448**
Total PV Project Size for Rebate Calculation (500 kW cap)	**10,448**
MA-manufactured components	YES
Public Building Adder	YES
Rebate ($)	**$ 41,792.00**
Rebate ($/watt dc) based on total project size	**$ 4.00000**
Key	
Entry Cells	
Calculation Cells (not for Entry)	

Click here for Financial Model

DRAFT 5.0 Non-Residential Solar Photovoltaic Project Simple
DATA ENTRY AND FINANCIAL SUMMARY

Key		
Entry Cells		
Cells Draw Data from Another Worksheet		
Calculation Cells (Not for Entry)		
Select Taxable or Non-Taxable Entity	Non-Taxable	
Project and Customer Cost Assumptions		
Solar Photovoltaic System Size	10,448	Watts (DC STC)
Total System Cost/Watt	$ 7.00	$/Watt (DC STC)
Total System Cost	$ 73,136	
MTC Rebate Assumptions		
MTC Scenario A: Non-Taxable Rebate	$ 4.000	$/Watt (DC STC)
Scenario A Rebate	$ 41,792	
MTC Scenario B: Taxable Rebate	$ 4.307	$/Watt (DC STC)
Scenario B Rebate	$ 45,000	
Project Performance and Savings/ Cost Assumptions		
Annual Net Capacity Factor	12.7%	kW (DC STC) to kWh AC
Annual Production Degradation	0.50%	%
Project Life	25	Years
Electricity Revenue (Avoided Costs)	$ 0.15	$/kWh
Electricity Revenue (Avoided Costs) Annual Adjustor	5.0%	%
Renewable Energy Certificate (REC) Revenue	$ 0.03	$/kWh
REC Revenue Annual Adjustor	0.0%	%
REC Revenue Term	3	Years (must be equal to or less thai
Annual Operations and Maintenance Cost	$ 250	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.75	$/Watt (DC STC)
Inverter Life, Replace Every X Years	15	Year (must be equal to or less than

Scenario Definitions

Scenario A: Non-Taxable Rebate - Assumes that the state rebate is non-taxable, but is subtracted from the cost basis for purposes of de

Scenario B: Taxable Rebate - Assumes that the state rebate is taxable, but is not subtracted from the cost basis for purposes of determi
Both Scenarios assume that the project owner can use both federal and state tax benefits

Tax Assumptions

Federal Tax Rate	0%					
State Tax Rate	0%					
Effective Tax Rate	0%					
Federal Tax Credit	0%					
State Tax Deduction	0%					
5 Year Accelerated Depreciation Schedule (MACRS)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Financing Assumptions

% Financed w/ Cash	100%	
% Financed w/ Loan	0%	
Loan Interest Rate	8%	
Loan Period	20	Years (must be equal to or less than project life)
Scenario A Net Cost	$ 31,344	
Scenario A Loan	$ -	
Scenario B Net Cost	$ 28,136	
Scenario B Loan	$ -	
Customer Discount Rate	6%	

Solar Project Financial Analysis Summary	
Scenario A: Net Present Value	**$ (3,207)**
Scenario A: Simple Payback (100% Cash only)	**Year 18**
Scenario A: Estimated Return on Equity	**#DIV/0!**
Scenario A: Guess Return on Equity	50%
Scenario B: Net Present Value	**$ 0**
Scenario B: Simple Payback (100% Cash only)	**Year 14**
Scenario B: Estimated Return on Equity	**#DIV/0!**
Scenario B: Guess Return on Equity	50%

PRO FORMA AND PRODUCTION

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Annual Generation (kWh)		11,624	11,565	11,508	11,450	11,393	11,336

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 1,744	$ 1,822	$ 1,903	$ 1,988	$ 2,077	$ 2,170
REC Revenue		$ 349	$ 347	$ 345	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 2,092	$ 2,169	$ 2,248	$ 1,988	$ 2,077	$ 2,170
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 1,842	$ 1,911	$ 1,983	$ 1,715	$ 1,796	$ 1,880
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 1,842	$ 1,911	$ 1,983	$ 1,715	$ 1,796	$ 1,880
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 1,842	$ 1,911	$ 1,983	$ 1,715	$ 1,796	$ 1,880
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Net Income		**$ 1,842**	**$ 1,911**	**$ 1,983**	**$ 1,715**	**$ 1,796**	**$ 1,880**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 1,842	$ 1,911	$ 1,983	$ 1,715	$ 1,796	$ 1,880
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 1,842	$ 1,911	$ 1,983	$ 1,715	$ 1,796	$ 1,880
Cash From Investing							
Installed PV Cost	$ (31,344)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (31,344)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ (31,344)**	**$ 1,842**	**$ 1,911**	**$ 1,983**	**$ 1,715**	**$ 1,796**	**$ 1,880**
Cumulative Cash Flow	**$ (31,344)**	**$ (29,502)**	**$ (27,591)**	**$ (25,608)**	**$ (23,893)**	**$ (22,097)**	**$ (20,216)**

PRO FORMA AND PRODUCTION

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Annual Generation (kWh)	11,279	11,223	11,167	11,111	11,055	11,000	10,945

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 2,267	$ 2,369	$ 2,475	$ 2,585	$ 2,701	$ 2,822	$ 2,948
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 2,267	$ 2,369	$ 2,475	$ 2,585	$ 2,701	$ 2,822	$ 2,948
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 1,969	$ 2,061	$ 2,158	$ 2,259	$ 2,365	$ 2,476	$ 2,592
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 1,969	$ 2,061	$ 2,158	$ 2,259	$ 2,365	$ 2,476	$ 2,592
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 1,969	$ 2,061	$ 2,158	$ 2,259	$ 2,365	$ 2,476	$ 2,592
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 1,969**	**$ 2,061**	**$ 2,158**	**$ 2,259**	**$ 2,365**	**$ 2,476**	**$ 2,592**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 1,969	$ 2,061	$ 2,158	$ 2,259	$ 2,365	$ 2,476	$ 2,592
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 1,969	$ 2,061	$ 2,158	$ 2,259	$ 2,365	$ 2,476	$ 2,592
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 1,969**	**$ 2,061**	**$ 2,158**	**$ 2,259**	**$ 2,365**	**$ 2,476**	**$ 2,592**
Cumulative Cash Flow	**$ (18,248)**	**$ (16,186)**	**$ (14,028)**	**$ (11,769)**	**$ (9,404)**	**$ (6,928)**	**$ (4,336)**

PRO FORMA AND PRODUCTION

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Annual Generation (kWh)	10,890	10,836	10,782	$ 10,728	10,674	10,621	10,568

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 3,080	$ 3,218	$ 3,362	$ 3,513	$ 3,670	$ 3,834	$ 4,006
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 3,080	$ 3,218	$ 3,362	$ 3,513	$ 3,670	$ 3,834	$ 4,006
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (7,836)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (8,214)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 2,713	$ (4,996)	$ 2,973	$ 3,111	$ 3,257	$ 3,408	$ 3,567
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 2,713	$ (4,996)	$ 2,973	$ 3,111	$ 3,257	$ 3,408	$ 3,567
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 2,713	$ (4,996)	$ 2,973	$ 3,111	$ 3,257	$ 3,408	$ 3,567
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 2,713**	**$ (4,996)**	**$ 2,973**	**$ 3,111**	**$ 3,257**	**$ 3,408**	**$ 3,567**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 2,713	$ (4,996)	$ 2,973	$ 3,111	$ 3,257	$ 3,408	$ 3,567
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 2,713	$ (4,996)	$ 2,973	$ 3,111	$ 3,257	$ 3,408	$ 3,567
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 2,713**	**$ (4,996)**	**$ 2,973**	**$ 3,111**	**$ 3,257**	**$ 3,408**	**$ 3,567**
Cumulative Cash Flow	**$ (1,623)**	**$ (6,619)**	**$ (3,646)**	**$ (535)**	**$ 2,722**	**$ 6,130**	**$ 9,698**

PRO FORMA AND PRODUCTION

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Annual Generation (kWh)	10,515	10,462	10,410	10,358	10,306

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 21	Year 22	Year 23	Year 24	Year 25
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 4,185	$ 4,372	$ 4,568	$ 4,772	$ 4,986
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 4,185	$ 4,372	$ 4,568	$ 4,772	$ 4,986
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 3,733	$ 3,907	$ 4,089	$ 4,279	$ 4,478
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 3,733	$ 3,907	$ 4,089	$ 4,279	$ 4,478
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 3,733	$ 3,907	$ 4,089	$ 4,279	$ 4,478
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 3,733**	**$ 3,907**	**$ 4,089**	**$ 4,279**	**$ 4,478**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 3,733	$ 3,907	$ 4,089	$ 4,279	$ 4,478
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 3,733	$ 3,907	$ 4,089	$ 4,279	$ 4,478
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 3,733**	**$ 3,907**	**$ 4,089**	**$ 4,279**	**$ 4,478**
Cumulative Cash Flow	**$ 13,431**	**$ 17,338**	**$ 21,427**	**$ 25,706**	**$ 30,183**

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 1,744	$ 1,822	$ 1,903	$ 1,988	$ 2,077	$ 2,170
REC Revenue		$ 349	$ 347	$ 345	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 2,092	$ 2,169	$ 2,248	$ 1,988	$ 2,077	$ 2,170
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 1,842	$ 1,911	$ 1,983	$ 1,715	$ 1,796	$ 1,880
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 1,842	$ 1,911	$ 1,983	$ 1,715	$ 1,796	$ 1,880
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 1,842	$ 1,911	$ 1,983	$ 1,715	$ 1,796	$ 1,880
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate		$ -					
Net Income		**$ 1,842**	**$ 1,911**	**$ 1,983**	**$ 1,715**	**$ 1,796**	**$ 1,880**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 1,842	$ 1,911	$ 1,983	$ 1,715	$ 1,796	$ 1,880
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 1,842	$ 1,911	$ 1,983	$ 1,715	$ 1,796	$ 1,880
Cash From Investing							
Installed PV Cost	$ (28,136)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (28,136)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ (28,136)**	**$ 1,842**	**$ 1,911**	**$ 1,983**	**$ 1,715**	**$ 1,796**	**$ 1,880**
Cumulative Cash Flow	**$ (28,136)**	**$ (26,294)**	**$ (24,383)**	**$ (22,400)**	**$ (20,685)**	**$ (18,889)**	**$ (17,009)**

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 2,267	$ 2,369	$ 2,475	$ 2,585	$ 2,701	$ 2,822	$ 2,948
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 2,267	$ 2,369	$ 2,475	$ 2,585	$ 2,701	$ 2,822	$ 2,948
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 1,969	$ 2,061	$ 2,158	$ 2,259	$ 2,365	$ 2,476	$ 2,592
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 1,969	$ 2,061	$ 2,158	$ 2,259	$ 2,365	$ 2,476	$ 2,592
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 1,969	$ 2,061	$ 2,158	$ 2,259	$ 2,365	$ 2,476	$ 2,592
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 1,969**	**$ 2,061**	**$ 2,158**	**$ 2,259**	**$ 2,365**	**$ 2,476**	**$ 2,592**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 1,969	$ 2,061	$ 2,158	$ 2,259	$ 2,365	$ 2,476	$ 2,592
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 1,969	$ 2,061	$ 2,158	$ 2,259	$ 2,365	$ 2,476	$ 2,592
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 1,969**	**$ 2,061**	**$ 2,158**	**$ 2,259**	**$ 2,365**	**$ 2,476**	**$ 2,592**
Cumulative Cash Flow	**$ (15,040)**	**$ (12,979)**	**$ (10,821)**	**$ (8,561)**	**$ (6,196)**	**$ (3,720)**	**$ (1,128)**

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 3,080	$ 3,218	$ 3,362	$ 3,513	$ 3,670	$ 3,834	$ 4,006
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 3,080	$ 3,218	$ 3,362	$ 3,513	$ 3,670	$ 3,834	$ 4,006
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (7,836)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (8,214)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 2,713	$ (4,996)	$ 2,973	$ 3,111	$ 3,257	$ 3,408	$ 3,567
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 2,713	$ (4,996)	$ 2,973	$ 3,111	$ 3,257	$ 3,408	$ 3,567
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 2,713	$ (4,996)	$ 2,973	$ 3,111	$ 3,257	$ 3,408	$ 3,567
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 2,713**	**$ (4,996)**	**$ 2,973**	**$ 3,111**	**$ 3,257**	**$ 3,408**	**$ 3,567**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 2,713	$ (4,996)	$ 2,973	$ 3,111	$ 3,257	$ 3,408	$ 3,567
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 2,713	$ (4,996)	$ 2,973	$ 3,111	$ 3,257	$ 3,408	$ 3,567
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 2,713**	**$ (4,996)**	**$ 2,973**	**$ 3,111**	**$ 3,257**	**$ 3,408**	**$ 3,567**
Cumulative Cash Flow	**$ 1,585**	**$ (3,411)**	**$ (438)**	**$ 2,673**	**$ 5,930**	**$ 9,338**	**$ 12,905**

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Scenario B: Taxable Rebate; Pro Forma Project Economics					
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 4,185	$ 4,372	$ 4,568	$ 4,772	$ 4,986
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 4,185	$ 4,372	$ 4,568	$ 4,772	$ 4,986
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 3,733	$ 3,907	$ 4,089	$ 4,279	$ 4,478
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 3,733	$ 3,907	$ 4,089	$ 4,279	$ 4,478
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 3,733	$ 3,907	$ 4,089	$ 4,279	$ 4,478
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate					
Net Income	**$ 3,733**	**$ 3,907**	**$ 4,089**	**$ 4,279**	**$ 4,478**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 3,733	$ 3,907	$ 4,089	$ 4,279	$ 4,478
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 3,733	$ 3,907	$ 4,089	$ 4,279	$ 4,478
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 3,733**	**$ 3,907**	**$ 4,089**	**$ 4,279**	**$ 4,478**
Cumulative Cash Flow	**$ 16,639**	**$ 20,546**	**$ 24,634**	**$ 28,913**	**$ 33,391**

ENGINE 41 STATION

Table 31: Engine 41 PV Profile

Building	
Building Name	Engine 41 / Ladder 14
Building Address	460 Cambridge Street Allston, MA
City Department	Boston Fire Department
Number of floors	
Square footage (if known)	
Fuel Type(s)	
Contact Information	
Facilities Manager	
Phone	
Email	
Electrical Connection	
Electric Utility Company	
Floor Plan showing Electrical room	Yes / No
Roof Details	
Roof slope/angle (Flat = 0°)	0°
Roof Orientation (S, SE, SW, etc.)	N/A
Roof Size – Square Feet	6851.75 sq ft
Roof Condition: poor, fair, good, excellent, new	Good
Roof Type (asphalt, shingles, rubber membrane, etc.)	Rubber
Expected life of roof (years)	
Equipment/obstructions on the roof	Small Ventilation Pipes
Detailed Roof Drawings available	Yes / No

Table 32: Engine 41 Summary of Findings

Summary of Findings	
Suited for Solar Water Heating?	Yes / No
Site Efficiency	96.17%
Area of roof available for panel installation	2,740 sq ft
Maximum number of panels that can be installed	170
DC Output of maximum number of panels	5,300 W
Net Capacity Factor (%)	12.8%
Cost of Installation:	

Figure 33: Engine 41 Solar Pathfinder Report

WPI Solar Team and Solar Boston Site Report

Report Name	Engine 41/Ladder 14
Report Date	4/14/2008 7:43:38 PM
Declination	-15d 11m
Location	ALLSTON, MA, Zipcode: 02134
Lat/Long	42.357 / -71.113
Weather Station	Boston, MA, Elevation: 6 m
Site distance	2.40 miles
Array Type	Fixed
Tilt Angle	42.36 deg
Ideal Tilt Angle	42.36 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Make	Evergreen Solar
Panel Model	ES-195-RL
Panel Count	170
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	SinglePicture
Layout Point Count	1

Notes: [None]
Report generated by SolarPathfinder Assistant Version 3.0.7.0. http://www.solarpathfinder.com
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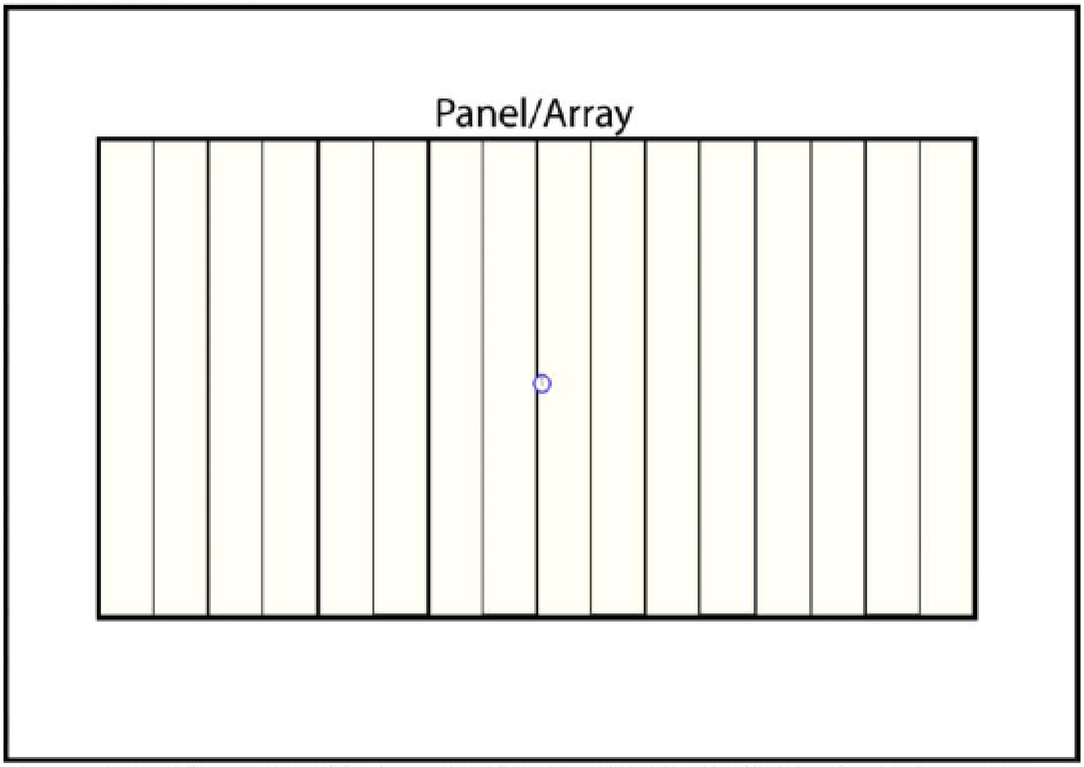
WPI Solar Team and Solar Boston System Picture Layout

Layout Type Single Picture
Layout Point Count 1



Report generated by SolarPathfinder Assistant Version 3.0.7.0. http://www.solarpathfinder.com
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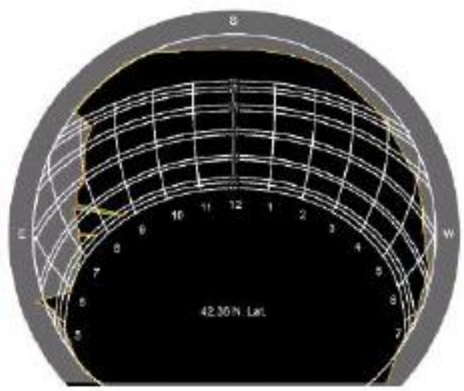
WPI Solar Team and Solar E[illegible]st Solar Site Analysis Report

Image File engine 41 -- ladder 14.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	98.00%	2.42	2111.00	2093.63
February	96.00%	3.19	2492.00	2424.62
March	95.00%	3.98	3470.00	3328.00
April	96.00%	4.31	3452.00	3323.38
May	96.00%	4.89	3940.00	3799.68
June	99.00%	5.67	4124.00	4094.70
July	98.00%	5.25	3973.00	3906.37
August	95.00%	4.80	3781.00	3620.31
September	93.00%	4.82	3838.00	3620.08
October	95.00%	3.66	3018.00	2882.83
November	95.00%	2.61	2162.00	2089.65
December	98.00%	2.29	1980.00	1959.98
Totals	**96.17%**	**47.90**	**38341.0**	**37143.23**
	Unweighted Yearly Avg	**Effect: 96.11% Sun Hrs: 3.99**		

Notes: [None]



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WPI Solar Team and Solar Bost Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	98.00%	2.42	2111.00	2093.63
February	96.00%	3.19	2492.00	2424.62
March	95.00%	3.98	3470.00	3328.00
April	96.00%	4.31	3452.00	3323.38
May	96.00%	4.89	3940.00	3799.68
June	99.00%	5.67	4124.00	4094.70
July	98.00%	5.25	3973.00	3906.37
August	95.00%	4.80	3781.00	3620.31
September	93.00%	4.82	3838.00	3620.08
October	95.00%	3.66	3018.00	2882.83
November	95.00%	2.61	2162.00	2089.65
December	98.00%	2.29	1980.00	1959.98
Totals	**96.17%**	**47.90**	**38341.0**	**37143.23**
	Unweighted Yearly Avg	**Effect: 96.11% Sun Hrs: 3.99**		

Notes: [None]

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Table 33: Engine 41 MTC Rebate Estimator Summary

Commonwealth Solar Non-Residential Solar Photovoltaic Calculator

Non-Residential: Commonwealth Solar Rebate Matrix ($/watt dc)				
Incremental Capacity	**1 to 25 kW** (1,000 to 25,000 watts)	**> 25 to 100 kW**	**> 100 kW to 200 kW**	**> 200 kW to 500 kW**
Base Incentive ($/watt dc)	$3.25	$2.50	$2.00	$1.50
PLUS: Additions to Base				
MA-Manufactured Components	$0.25	$0.25	$0.25	$0.25
Public Building Adder	$0.50	$0.50	$0.25	$0.25

Non-Residential: Commonwealth Solar Rebate Calculator	
Total PV Project Size (watts dc)	**5,300**
Total PV Project Size for Rebate Calculation (500 kW cap)	**5,300**
MA-manufactured components	YES
Public Building Adder	YES
Rebate ($)	**$ 21,200.00**
Rebate ($/watt dc) based on total project size	**$ 4.00000**
Key	
Entry Cells	
Calculation Cells (not for Entry)	

Click here for Financial Model

DATA ENTRY AND FINANCIAL SUMMARY

Key

Entry Cells	(green)
Cells Draw Data from Another Worksheet	(yellow)
Calculation Cells (Not for Entry)	(white)

Select Taxable or Non-Taxable Entity	Non-Taxable	
Project and Customer Cost Assumptions		
Solar Photovoltaic System Size	5,300	Watts (DC STC)
Total System Cost/Watt	$ 7.00	$/Watt (DC STC)
Total System Cost	$ 37,100	
MTC Rebate Assumptions		
MTC Scenario A: Non-Taxable Rebate	$ 4.000	$/Watt (DC STC)
Scenario A Rebate	$ 21,200	
MTC Scenario B: Taxable Rebate	$ 4.677	$/Watt (DC STC)
Scenario B Rebate	$ 24,788	
Project Performance and Savings/ Cost Assumptions		
Annual Net Capacity Factor	12.8%	kW (DC STC) to kWh AC
Annual Production Degradation	0.50%	%
Project Life	25	Years
Electricity Revenue (Avoided Costs)	$ 0.15	$/kWh
Electricity Revenue (Avoided Costs) Annual Adjustor	5.0%	%
Renewable Energy Certificate (REC) Revenue	$ 0.03	$/kWh
REC Revenue Annual Adjustor	0.0%	%
REC Revenue Term	3	Years (must be equal to or less thai
Annual Operations and Maintenance Cost	$ 250	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.75	$/Watt (DC STC)
Inverter Life, Replace Every X Years	15	Year (must be equal to or less than

Scenario Definitions

Scenario A: Non-Taxable Rebate - Assumes that the state rebate is non-taxable, but is subtracted from the cost basis for purposes of determ

Scenario B: Taxable Rebate - Assumes that the state rebate is taxable, but is not subtracted from the cost basis for purposes of determining

Both Scenarios assume that the project owner can use both federal and state tax benefits

Tax Assumptions

Federal Tax Rate	0%					
State Tax Rate	0%					
Effective Tax Rate	0%					
Federal Tax Credit	0%					
State Tax Deduction	0%					
5 Year Accelerated Depreciation Schedule (MACRS)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Financing Assumptions

% Financed w/ Cash	100%	
% Financed w/ Loan	0%	
Loan Interest Rate	8%	
Loan Period	20	Years (must be equal to or less than project life)
Scenario A Net Cost	$ 15,900	
Scenario A Loan	$ -	
Scenario B Net Cost	$ 12,312	
Scenario B Loan	$ -	
Customer Discount Rate	6%	

Solar Project Financial Analysis Summary	
Scenario A: Net Present Value	**$ (3,587)**
Scenario A: Simple Payback (100% Cash only)	**Year 19**
Scenario A: Estimated Return on Equity	**#DIV/0!**
Scenario A: Guess Return on Equity	50%
Scenario B: Net Present Value	**$ 1**
Scenario B: Simple Payback (100% Cash only)	**Year 14**
Scenario B: Estimated Return on Equity	**#DIV/0!**
Scenario B: Guess Return on Equity	50%

PRO FORMA AND PRODUCTION

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Annual Generation (kWh)		5,943	5,913	5,884	5,854	5,825	5,796

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 891	$ 931	$ 973	$ 1,017	$ 1,062	$ 1,110
REC Revenue		$ 178	$ 177	$ 177	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 1,070	$ 1,109	$ 1,149	$ 1,017	$ 1,062	$ 1,110
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 820	$ 851	$ 884	$ 743	$ 781	$ 820
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 820	$ 851	$ 884	$ 743	$ 781	$ 820
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 820	$ 851	$ 884	$ 743	$ 781	$ 820
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Net Income		**$ 820**	**$ 851**	**$ 884**	**$ 743**	**$ 781**	**$ 820**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 820	$ 851	$ 884	$ 743	$ 781	$ 820
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 820	$ 851	$ 884	$ 743	$ 781	$ 820
Cash From Investing							
Installed PV Cost	$ (15,900)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (15,900)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ (15,900)**	**$ 820**	**$ 851**	**$ 884**	**$ 743**	**$ 781**	**$ 820**
Cumulative Cash Flow	**$ (15,900)**	**$ (15,080)**	**$ (14,229)**	**$ (13,345)**	**$ (12,601)**	**$ (11,821)**	**$ (11,001)**

PRO FORMA AND PRODUCTION

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Annual Generation (kWh)	5,767	5,738	5,709	5,681	5,652	5,624	5,596

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 1,159	$ 1,211	$ 1,265	$ 1,322	$ 1,381	$ 1,443	$ 1,507
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,159	$ 1,211	$ 1,265	$ 1,322	$ 1,381	$ 1,443	$ 1,507
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 861	$ 904	$ 949	$ 996	$ 1,045	$ 1,097	$ 1,151
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 861	$ 904	$ 949	$ 996	$ 1,045	$ 1,097	$ 1,151
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 861	$ 904	$ 949	$ 996	$ 1,045	$ 1,097	$ 1,151
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 861**	**$ 904**	**$ 949**	**$ 996**	**$ 1,045**	**$ 1,097**	**$ 1,151**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 861	$ 904	$ 949	$ 996	$ 1,045	$ 1,097	$ 1,151
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 861	$ 904	$ 949	$ 996	$ 1,045	$ 1,097	$ 1,151
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 861**	**$ 904**	**$ 949**	**$ 996**	**$ 1,045**	**$ 1,097**	**$ 1,151**
Cumulative Cash Flow	**$ (10,140)**	**$ (9,237)**	**$ (8,288)**	**$ (7,293)**	**$ (6,248)**	**$ (5,151)**	**$ (4,000)**

PRO FORMA AND PRODUCTION

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Annual Generation (kWh)	5,568	5,540	5,512	$ 5,485	5,457	5,430	5,403

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 1,575	$ 1,645	$ 1,719	$ 1,796	$ 1,876	$ 1,960	$ 2,048
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,575	$ 1,645	$ 1,719	$ 1,796	$ 1,876	$ 1,960	$ 2,048
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (3,975)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (4,353)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 1,208	$ (2,708)	$ 1,329	$ 1,395	$ 1,463	$ 1,535	$ 1,610
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 1,208	$ (2,708)	$ 1,329	$ 1,395	$ 1,463	$ 1,535	$ 1,610
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 1,208	$ (2,708)	$ 1,329	$ 1,395	$ 1,463	$ 1,535	$ 1,610
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 1,208**	**$ (2,708)**	**$ 1,329**	**$ 1,395**	**$ 1,463**	**$ 1,535**	**$ 1,610**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 1,208	$ (2,708)	$ 1,329	$ 1,395	$ 1,463	$ 1,535	$ 1,610
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 1,208	$ (2,708)	$ 1,329	$ 1,395	$ 1,463	$ 1,535	$ 1,610
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 1,208**	**$ (2,708)**	**$ 1,329**	**$ 1,395**	**$ 1,463**	**$ 1,535**	**$ 1,610**
Cumulative Cash Flow	**$ (2,792)**	**$ (5,500)**	**$ (4,170)**	**$ (2,776)**	**$ (1,313)**	**$ 222**	**$ 1,832**

PRO FORMA AND PRODUCTION

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Annual Generation (kWh)	5,376	5,349	5,322	5,296	5,269

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 21	Year 22	Year 23	Year 24	Year 25
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 2,140	$ 2,235	$ 2,335	$ 2,440	$ 2,549
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 2,140	$ 2,235	$ 2,335	$ 2,440	$ 2,549
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 1,688	$ 1,770	$ 1,856	$ 1,946	$ 2,041
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 1,688	$ 1,770	$ 1,856	$ 1,946	$ 2,041
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 1,688	$ 1,770	$ 1,856	$ 1,946	$ 2,041
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 1,688**	**$ 1,770**	**$ 1,856**	**$ 1,946**	**$ 2,041**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 1,688	$ 1,770	$ 1,856	$ 1,946	$ 2,041
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 1,688	$ 1,770	$ 1,856	$ 1,946	$ 2,041
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 1,688**	**$ 1,770**	**$ 1,856**	**$ 1,946**	**$ 2,041**
Cumulative Cash Flow	**$ 3,520**	**$ 5,290**	**$ 7,146**	**$ 9,093**	**$ 11,133**

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 891	$ 931	$ 973	$ 1,017	$ 1,062	$ 1,110
REC Revenue		$ 178	$ 177	$ 177	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 1,070	$ 1,109	$ 1,149	$ 1,017	$ 1,062	$ 1,110
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 820	$ 851	$ 884	$ 743	$ 781	$ 820
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 820	$ 851	$ 884	$ 743	$ 781	$ 820
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 820	$ 851	$ 884	$ 743	$ 781	$ 820
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate		$ -					
Net Income		**$ 820**	**$ 851**	**$ 884**	**$ 743**	**$ 781**	**$ 820**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 820	$ 851	$ 884	$ 743	$ 781	$ 820
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 820	$ 851	$ 884	$ 743	$ 781	$ 820
Cash From Investing							
Installed PV Cost	$ (12,312)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (12,312)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ (12,312)**	**$ 820**	**$ 851**	**$ 884**	**$ 743**	**$ 781**	**$ 820**
Cumulative Cash Flow	**$ (12,312)**	**$ (11,492)**	**$ (10,641)**	**$ (9,757)**	**$ (9,013)**	**$ (8,233)**	**$ (7,413)**

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 1,159	$ 1,211	$ 1,265	$ 1,322	$ 1,381	$ 1,443	$ 1,507
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,159	$ 1,211	$ 1,265	$ 1,322	$ 1,381	$ 1,443	$ 1,507
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 861	$ 904	$ 949	$ 996	$ 1,045	$ 1,097	$ 1,151
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 861	$ 904	$ 949	$ 996	$ 1,045	$ 1,097	$ 1,151
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 861	$ 904	$ 949	$ 996	$ 1,045	$ 1,097	$ 1,151
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 861**	**$ 904**	**$ 949**	**$ 996**	**$ 1,045**	**$ 1,097**	**$ 1,151**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 861	$ 904	$ 949	$ 996	$ 1,045	$ 1,097	$ 1,151
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 861	$ 904	$ 949	$ 996	$ 1,045	$ 1,097	$ 1,151
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 861**	**$ 904**	**$ 949**	**$ 996**	**$ 1,045**	**$ 1,097**	**$ 1,151**
Cumulative Cash Flow	**$ (6,552)**	**$ (5,649)**	**$ (4,700)**	**$ (3,704)**	**$ (2,659)**	**$ (1,563)**	**$ (412)**

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 1,575	$ 1,645	$ 1,719	$ 1,796	$ 1,876	$ 1,960	$ 2,048
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,575	$ 1,645	$ 1,719	$ 1,796	$ 1,876	$ 1,960	$ 2,048
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (3,975)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (4,353)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 1,208	$ (2,708)	$ 1,329	$ 1,395	$ 1,463	$ 1,535	$ 1,610
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 1,208	$ (2,708)	$ 1,329	$ 1,395	$ 1,463	$ 1,535	$ 1,610
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 1,208	$ (2,708)	$ 1,329	$ 1,395	$ 1,463	$ 1,535	$ 1,610
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 1,208**	**$ (2,708)**	**$ 1,329**	**$ 1,395**	**$ 1,463**	**$ 1,535**	**$ 1,610**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 1,208	$ (2,708)	$ 1,329	$ 1,395	$ 1,463	$ 1,535	$ 1,610
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 1,208	$ (2,708)	$ 1,329	$ 1,395	$ 1,463	$ 1,535	$ 1,610
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 1,208**	**$ (2,708)**	**$ 1,329**	**$ 1,395**	**$ 1,463**	**$ 1,535**	**$ 1,610**
Cumulative Cash Flow	**$ 796**	**$ (1,912)**	**$ (582)**	**$ 812**	**$ 2,275**	**$ 3,810**	**$ 5,420**

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Scenario B: Taxable Rebate; Pro Forma Project Economics					
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 2,140	$ 2,235	$ 2,335	$ 2,440	$ 2,549
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 2,140	$ 2,235	$ 2,335	$ 2,440	$ 2,549
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 1,688	$ 1,770	$ 1,856	$ 1,946	$ 2,041
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 1,688	$ 1,770	$ 1,856	$ 1,946	$ 2,041
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 1,688	$ 1,770	$ 1,856	$ 1,946	$ 2,041
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate					
Net Income	**$ 1,688**	**$ 1,770**	**$ 1,856**	**$ 1,946**	**$ 2,041**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 1,688	$ 1,770	$ 1,856	$ 1,946	$ 2,041
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 1,688	$ 1,770	$ 1,856	$ 1,946	$ 2,041
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 1,688**	**$ 1,770**	**$ 1,856**	**$ 1,946**	**$ 2,041**
Cumulative Cash Flow	**$ 7,108**	**$ 8,878**	**$ 10,734**	**$ 12,681**	**$ 14,722**

FRANKLIN PARK ADMINISTRATION BUILDING

Table 34: Franklin Park Admin Bldg PV Profile

Building	
Building Name	Franklin Park Administration Building
Building Address	Franklin Park Circuit Drive Complex Boston, MA
City Department	Boston Parks and Recreation
Number of floors	
Square footage (if known)	
Fuel Type(s)	
Contact Information	
Facilities Manager	Bernie Lynch
Phone	(617) 635-7377
Email	
Electrical Connection	
Electric Utility Company	
Floor Plan showing Electrical room	Yes / No
Roof Details	
Roof slope/angle (Flat = 0°)	
Roof Orientation (S, SE, SW, etc.)	
Roof Size – Square Feet	43514.38 sq ft
Roof Condition: poor, fair, good, excellent, new	
Roof Type (asphalt, shingles, rubber membrane, etc.)	
Expected life of roof (years)	
Equipment/obstructions on the roof	If Yes, please describe briefly
Detailed Roof Drawings available	Yes / No

Table 35: Franklin Park Admin Bldg Summary of Findings

Summary of Findings	
Suited for Solar Water Heating?	No
Site Efficiency	78.21%
Area of roof available for panel installation	17405 sq ft
Maximum number of panels that can be installed	1000
DC Output of maximum number of panels	2633 W
Net Capacity Factor (%)	10.8%
Cost of Installation:	

Figure 34: Franklin Park Admin Bldg Solar Pathfinder Report

WPI Solar Team and Solar Boston Site Report

Report Name	Franklin Park
Report Date	4/14/2008 12:53:35 PM
Declination	-15d 10m
Location	JAMAICA PLAIN, MA, Zipcode: 02130
Lat/Long	42.31 / -71.121
Weather Station	Boston, MA, Elevation: 6 m
Site distance	3.94 miles
Array Type	Fixed
Tilt Angle	42.31 deg
Ideal Tilt Angle	42.31 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Make	Evergreen Solar
Panel Model	ES-195-RL
Panel Count	1000
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	Custom
Layout Point Count	4

Notes: next summer comes new roof

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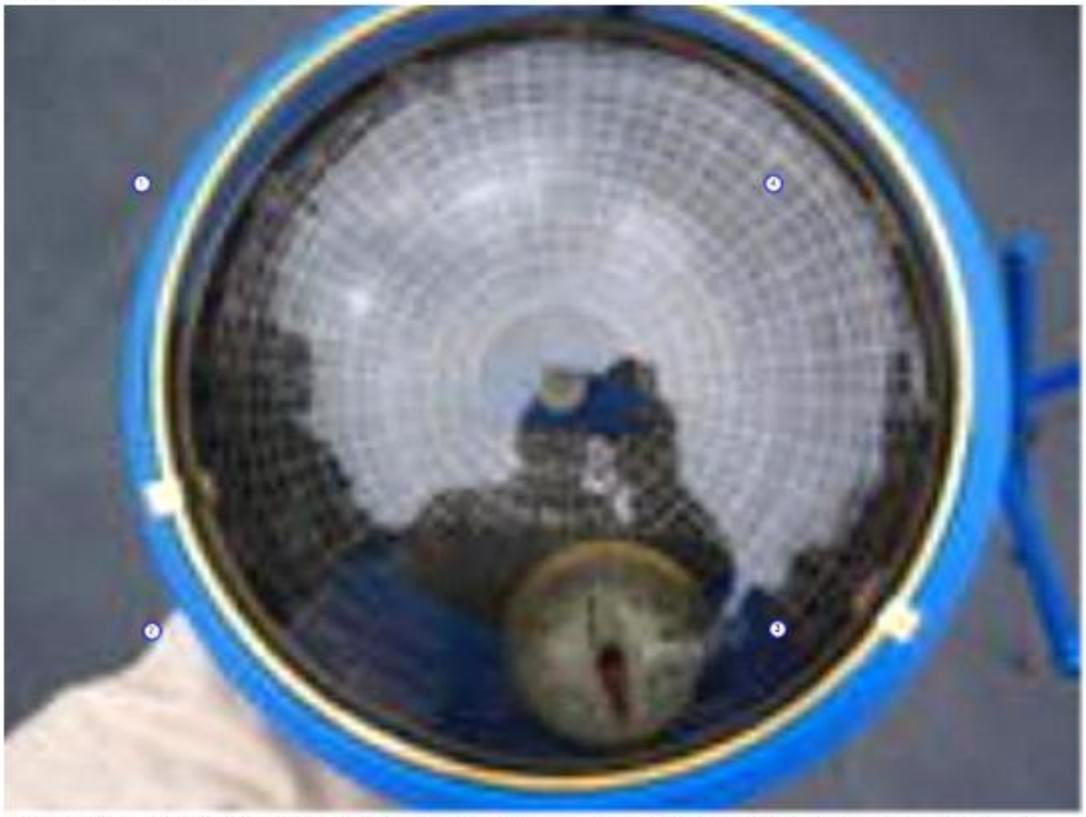
WPI Solar Team and Solar Boston System Picture Layout

Layout Type Custom
Layout Point Count 4



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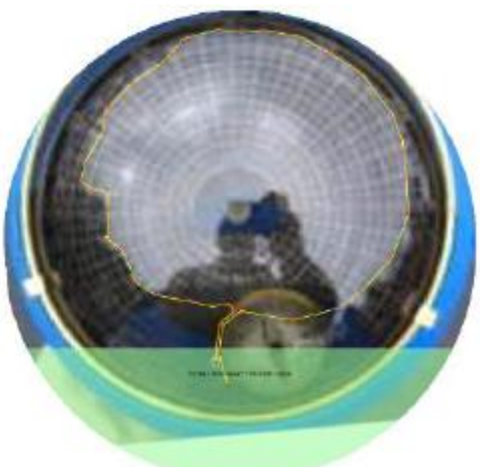
WPI Solar Team and Solar E 1 st
Solar Site Analysis Report

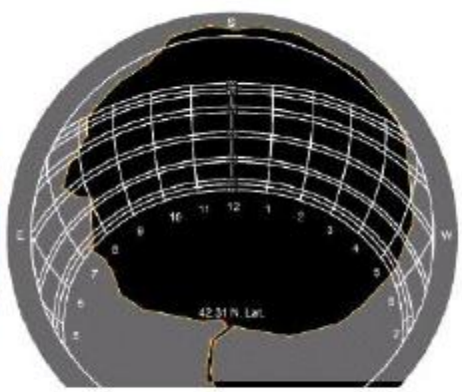
Image File th_FranklinPark 1.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.31	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.31 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	99.00%	2.46	12416.00	12350.38
February	97.00%	3.23	14648.00	14413.33
March	97.00%	4.06	20424.00	19988.19
April	93.00%	4.17	20312.00	19103.20
May	91.00%	4.67	23182.00	21603.55
June	92.00%	5.28	24263.00	22952.20
July	94.00%	5.03	23374.00	22303.81
August	91.00%	4.61	22247.00	20648.61
September	95.00%	4.87	22573.00	21611.72
October	97.00%	3.73	17749.00	17295.60
November	96.00%	2.64	12717.00	12344.84
December	98.00%	2.29	11641.00	11464.64
Totals	**95.03%**	**47.05**	**225546.0**	**216080.07**
	Unweighted Yearly Avg	**Effect: 94.42% Sun Hrs: 3.92**		

Notes: [None]





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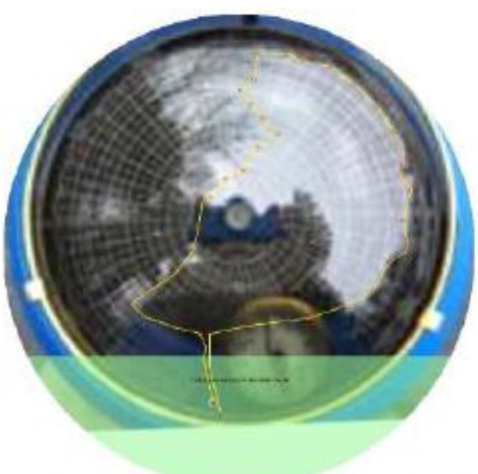
WPI Solar Team and Solar E2st
Solar Site Analysis Report

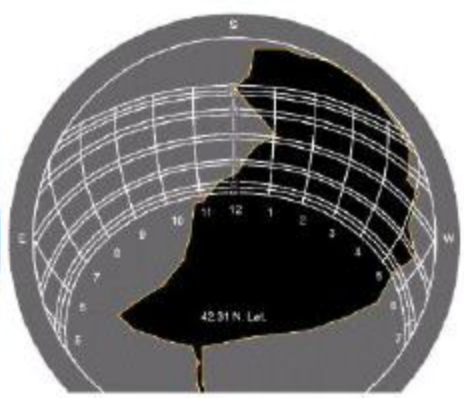
Image File th_FranklinPark2.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.31	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.31 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	56.00%	1.38	12416.00	6901.51
February	44.00%	1.47	14648.00	6525.44
March	33.00%	1.39	20424.00	6776.44
April	46.00%	2.09	20312.00	9469.89
May	51.00%	2.58	23182.00	11805.36
June	54.00%	3.07	24263.00	13195.96
July	55.00%	2.95	23374.00	12973.10
August	41.00%	2.08	22247.00	9091.62
September	32.00%	1.66	22573.00	7264.88
October	37.00%	1.41	17749.00	6481.48
November	43.00%	1.17	12717.00	5385.98
December	46.00%	1.08	11641.00	5385.85
Totals	**44.82%**	**22.34**	**225546.0**	**101257.51**
	Unweighted Yearly Avg	**Effect: 44.83% Sun Hrs: 1.86**		

Notes: [None]





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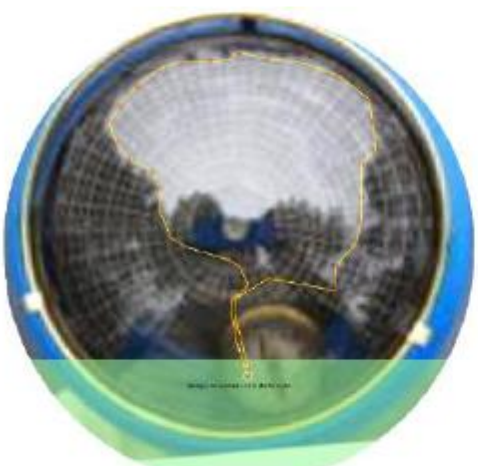
WPI Solar Team and Solar E 3 st
Solar Site Analysis Report

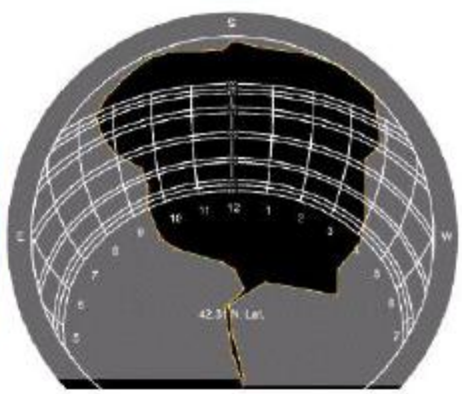
Image File th_FranklinPark3.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.31	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.31 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	95.00%	2.36	12416.00	12070.11
February	91.00%	3.00	14648.00	13491.62
March	80.00%	3.34	20424.00	16511.24
April	73.00%	3.27	20312.00	15102.29
May	70.00%	3.55	23182.00	16542.65
June	69.00%	3.97	24263.00	17266.11
July	73.00%	3.91	23374.00	17436.81
August	70.00%	3.52	22247.00	15859.60
September	75.00%	3.88	22573.00	17281.02
October	86.00%	3.32	17749.00	15458.46
November	92.00%	2.53	12717.00	11931.89
December	95.00%	2.22	11641.00	11200.65
Totals	**80.72%**	**38.89**	**225546.0**	**180152.44**
	Unweighted Yearly Avg	**Effect: 78.04% Sun Hrs: 3.24**		

Notes: [None]





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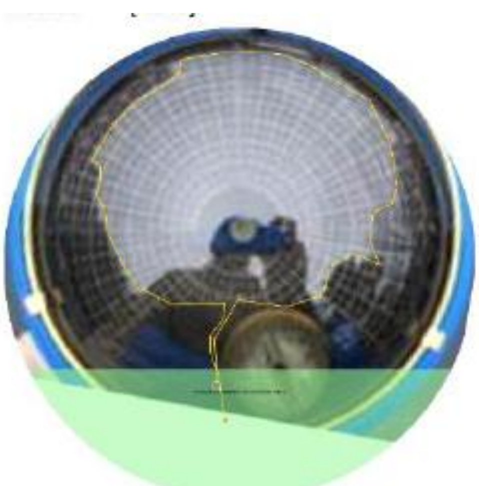
WPI Solar Team and Solar E 4 st
Solar Site Analysis Report

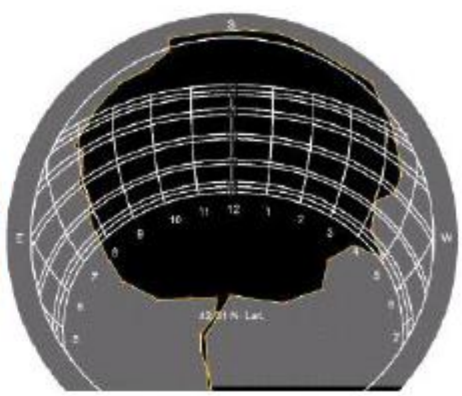
Image File th_FranklinPark4.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.31	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.31 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	98.00%	2.44	12416.00	12325.88
February	96.00%	3.18	14648.00	14229.91
March	94.00%	3.94	20424.00	19424.12
April	88.00%	3.98	20312.00	18364.21
May	87.00%	4.45	23182.00	20726.51
June	88.00%	5.02	24263.00	21929.97
July	90.00%	4.83	23374.00	21559.31
August	88.00%	4.44	22247.00	20025.16
September	91.00%	4.70	22573.00	20930.70
October	94.00%	3.63	17749.00	16856.30
November	96.00%	2.64	12717.00	12406.99
December	97.00%	2.27	11641.00	11405.86
Totals	**92.34%**	**45.52**	**225546.0**	**210184.89**
	Unweighted Yearly Avg	**Effect: 91.34% Sun Hrs: 3.79**		

Notes: [None]





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WPI Solar Team and Solar Bost Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.31	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.31 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	87.00%	2.16	12416.00	10911.97
February	82.00%	2.72	14648.00	12165.08
March	76.00%	3.18	20424.00	15675.00
April	75.00%	3.38	20312.00	15509.90
May	74.75%	3.81	23182.00	17669.52
June	75.75%	4.34	24263.00	18836.06
July	78.00%	4.18	23374.00	18568.26
August	72.50%	3.66	22247.00	16406.25
September	73.25%	3.78	22573.00	16772.08
October	78.50%	3.02	17749.00	14022.96
November	81.75%	2.25	12717.00	10517.43
December	84.00%	1.97	11641.00	9864.25
Totals	**78.21%**	**47.05**	**225546.0**	**176918.74**
	Unweighted Yearly Avg	**Effect: 77.16% Sun Hrs: 3.20**		

Notes: next summer comes new roof

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Table 36: Franklin Park Admin Bldg MTC Rebate Estimator Summary

Commonwealth Solar Non-Residential Solar Photovoltaic Calculator

Non-Residential: Commonwealth Solar Rebate Matrix ($/watt dc)				
Incremental Capacity	**1 to 25 kW** (1,000 to 25,000 watts)	**> 25 to 100 kW**	**> 100 kW to 200 kW**	**> 200 kW to 500 kW**
Base Incentive ($/watt dc)	$3.25	$2.50	$2.00	$1.50
PLUS: Additions to Base				
MA-Manufactured Components	$0.25	$0.25	$0.25	$0.25
Public Building Adder	$0.50	$0.50	$0.25	$0.25

Non-Residential: Commonwealth Solar Rebate Calculator	
Total PV Project Size (watts dc)	**2,633**
Total PV Project Size for Rebate Calculation (500 kW cap)	**2,633**
MA-manufactured components	YES
Public Building Adder	YES
Rebate ($)	**$ 10,532.00**
Rebate ($/watt dc) based on total project size	**$ 4.00000**
Key	
Entry Cells	
Calculation Cells (not for Entry)	

Click here for Financial Model

DATA ENTRY AND FINANCIAL SUMMARY

Key

Entry Cells	
Cells Draw Data from Another Worksheet	
Calculation Cells (Not for Entry)	

Select Taxable or Non-Taxable Entity	Non-Taxable	
Project and Customer Cost Assumptions		
Solar Photovoltaic System Size	2,633	Watts (DC STC)
Total System Cost/Watt	$ 7.00	$/Watt (DC STC)
Total System Cost	$ 18,431	
MTC Rebate Assumptions		
MTC Scenario A: Non-Taxable Rebate	$ 4.000	$/Watt (DC STC)
Scenario A Rebate	$ 10,532	
MTC Scenario B: Taxable Rebate	$ 6.031	$/Watt (DC STC)
Scenario B Rebate	$ 15,880	
Project Performance and Savings/ Cost Assumptions		
Annual Net Capacity Factor	10.8%	kW (DC STC) to kWh AC
Annual Production Degradation	0.50%	%
Project Life	25	Years
Electricity Revenue (Avoided Costs)	$ 0.15	$/kWh
Electricity Revenue (Avoided Costs) Annual Adjustor	5.0%	%
Renewable Energy Certificate (REC) Revenue	$ 0.03	$/kWh
REC Revenue Annual Adjustor	0.0%	%
REC Revenue Term	3	Years (must be equal to or less than project life)
Annual Operations and Maintenance Cost	$ 250	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.75	$/Watt (DC STC)
Inverter Life, Replace Every X Years	15	Year (must be equal to or less than project life)

Scenario Definitions

Scenario A: Non-Taxable Rebate - Assumes that the state rebate is non-taxable, but is subtracted from the cost basis for purposes of determini

Scenario B: Taxable Rebate - Assumes that the state rebate is taxable, but is not subtracted from the cost basis for purposes of determining tax

Both Scenarios assume that the project owner can use both federal and state tax benefits

Tax Assumptions

Federal Tax Rate	0%					
State Tax Rate	0%					
Effective Tax Rate	0%					
Federal Tax Credit	0%					
State Tax Deduction	0%					
5 Year Accelerated Depreciation Schedule (MACRS)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Financing Assumptions

% Financed w/ Cash	100%	
% Financed w/ Loan	0%	
Loan Interest Rate	8%	
Loan Period	20	Years (must be equal to or less than project life)
Scenario A Net Cost	$ 7,899	
Scenario A Loan	$ -	
Scenario B Net Cost	$ 2,551	
Scenario B Loan	$ -	
Customer Discount Rate	6%	

Solar Project Financial Analysis Summary

Scenario A: Net Present Value	**$ (5,346)**
Scenario A: Simple Payback (100% Cash only)	**Year**
Scenario A: Estimated Return on Equity	**#DIV/0!**
Scenario A: Guess Return on Equity	50%
Scenario B: Net Present Value	**$ 2**
Scenario B: Simple Payback (100% Cash only)	**Year 13**
Scenario B: Estimated Return on Equity	**#DIV/0!**
Scenario B: Guess Return on Equity	50%

PRO FORMA AND PRODUCTION

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Annual Generation (kWh)		2,491	2,479	2,466	2,454	2,442	2,429

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 374	$ 390	$ 408	$ 426	$ 445	$ 465
REC Revenue		$ 75	$ 74	$ 74	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 448	$ 465	$ 482	$ 426	$ 445	$ 465
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 198	$ 207	$ 217	$ 153	$ 164	$ 175
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 198	$ 207	$ 217	$ 153	$ 164	$ 175
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 198	$ 207	$ 217	$ 153	$ 164	$ 175
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Net Income		**$ 198**	**$ 207**	**$ 217**	**$ 153**	**$ 164**	**$ 175**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 198	$ 207	$ 217	$ 153	$ 164	$ 175
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 198	$ 207	$ 217	$ 153	$ 164	$ 175
Cash From Investing							
Installed PV Cost	$ (7,899)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (7,899)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ (7,899)**	**$ 198**	**$ 207**	**$ 217**	**$ 153**	**$ 164**	**$ 175**
Cumulative Cash Flow	**$ (7,899)**	**$ (7,701)**	**$ (7,493)**	**$ (7,277)**	**$ (7,124)**	**$ (6,960)**	**$ (6,785)**

PRO FORMA AND PRODUCTION

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Annual Generation (kWh)	2,417	2,405	2,393	2,381	2,369	2,357	2,346

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 486	$ 508	$ 530	$ 554	$ 579	$ 605	$ 632
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 486	$ 508	$ 530	$ 554	$ 579	$ 605	$ 632
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 187	$ 200	$ 214	$ 228	$ 243	$ 259	$ 275
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 187	$ 200	$ 214	$ 228	$ 243	$ 259	$ 275
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 187	$ 200	$ 214	$ 228	$ 243	$ 259	$ 275
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 187**	**$ 200**	**$ 214**	**$ 228**	**$ 243**	**$ 259**	**$ 275**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 187	$ 200	$ 214	$ 228	$ 243	$ 259	$ 275
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 187	$ 200	$ 214	$ 228	$ 243	$ 259	$ 275
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 187**	**$ 200**	**$ 214**	**$ 228**	**$ 243**	**$ 259**	**$ 275**
Cumulative Cash Flow	**$ (6,597)**	**$ (6,397)**	**$ (6,184)**	**$ (5,956)**	**$ (5,713)**	**$ (5,454)**	**$ (5,179)**

PRO FORMA AND PRODUCTION

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Annual Generation (kWh)	2,334	2,322	2,311	$ 2,299	2,288	2,276	2,265

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 660	$ 690	$ 721	$ 753	$ 786	$ 822	$ 858
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 660	$ 690	$ 721	$ 753	$ 786	$ 822	$ 858
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (1,975)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (2,353)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 293	$ (1,663)	$ 331	$ 352	$ 373	$ 396	$ 420
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 293	$ (1,663)	$ 331	$ 352	$ 373	$ 396	$ 420
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 293	$ (1,663)	$ 331	$ 352	$ 373	$ 396	$ 420
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 293**	**$ (1,663)**	**$ 331**	**$ 352**	**$ 373**	**$ 396**	**$ 420**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 293	$ (1,663)	$ 331	$ 352	$ 373	$ 396	$ 420
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 293	$ (1,663)	$ 331	$ 352	$ 373	$ 396	$ 420
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 293**	**$ (1,663)**	**$ 331**	**$ 352**	**$ 373**	**$ 396**	**$ 420**
Cumulative Cash Flow	**$ (4,886)**	**$ (6,549)**	**$ (6,218)**	**$ (5,866)**	**$ (5,493)**	**$ (5,097)**	**$ (4,677)**

PRO FORMA AND PRODUCTION

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Annual Generation (kWh)	2,253	2,242	2,231	2,220	2,209

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 21	Year 22	Year 23	Year 24	Year 25
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 897	$ 937	$ 979	$ 1,023	$ 1,068
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 897	$ 937	$ 979	$ 1,023	$ 1,068
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 445	$ 472	$ 500	$ 529	$ 560
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 445	$ 472	$ 500	$ 529	$ 560
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 445	$ 472	$ 500	$ 529	$ 560
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 445**	**$ 472**	**$ 500**	**$ 529**	**$ 560**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 445	$ 472	$ 500	$ 529	$ 560
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 445	$ 472	$ 500	$ 529	$ 560
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 445**	**$ 472**	**$ 500**	**$ 529**	**$ 560**
Cumulative Cash Flow	**$ (4,232)**	**$ (3,760)**	**$ (3,260)**	**$ (2,730)**	**$ (2,170)**

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 374	$ 390	$ 408	$ 426	$ 445	$ 465
REC Revenue		$ 75	$ 74	$ 74	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 448	$ 465	$ 482	$ 426	$ 445	$ 465
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 198	$ 207	$ 217	$ 153	$ 164	$ 175
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 198	$ 207	$ 217	$ 153	$ 164	$ 175
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 198	$ 207	$ 217	$ 153	$ 164	$ 175
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate		$ -					
Net Income		**$ 198**	**$ 207**	**$ 217**	**$ 153**	**$ 164**	**$ 175**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 198	$ 207	$ 217	$ 153	$ 164	$ 175
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 198	$ 207	$ 217	$ 153	$ 164	$ 175
Cash From Investing							
Installed PV Cost	$ (2,551)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (2,551)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ (2,551)**	**$ 198**	**$ 207**	**$ 217**	**$ 153**	**$ 164**	**$ 175**
Cumulative Cash Flow	**$ (2,551)**	**$ (2,353)**	**$ (2,146)**	**$ (1,929)**	**$ (1,776)**	**$ (1,612)**	**$ (1,437)**

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 486	$ 508	$ 530	$ 554	$ 579	$ 605	$ 632
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 486	$ 508	$ 530	$ 554	$ 579	$ 605	$ 632
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 187	$ 200	$ 214	$ 228	$ 243	$ 259	$ 275
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 187	$ 200	$ 214	$ 228	$ 243	$ 259	$ 275
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 187	$ 200	$ 214	$ 228	$ 243	$ 259	$ 275
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 187**	**$ 200**	**$ 214**	**$ 228**	**$ 243**	**$ 259**	**$ 275**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 187	$ 200	$ 214	$ 228	$ 243	$ 259	$ 275
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 187	$ 200	$ 214	$ 228	$ 243	$ 259	$ 275
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 187**	**$ 200**	**$ 214**	**$ 228**	**$ 243**	**$ 259**	**$ 275**
Cumulative Cash Flow	**$ (1,250)**	**$ (1,050)**	**$ (836)**	**$ (608)**	**$ (365)**	**$ (106)**	**$ 169**

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 660	$ 690	$ 721	$ 753	$ 786	$ 822	$ 858
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 660	$ 690	$ 721	$ 753	$ 786	$ 822	$ 858
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (1,975)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (2,353)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 293	$ (1,663)	$ 331	$ 352	$ 373	$ 396	$ 420
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 293	$ (1,663)	$ 331	$ 352	$ 373	$ 396	$ 420
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 293	$ (1,663)	$ 331	$ 352	$ 373	$ 396	$ 420
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 293**	**$ (1,663)**	**$ 331**	**$ 352**	**$ 373**	**$ 396**	**$ 420**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 293	$ (1,663)	$ 331	$ 352	$ 373	$ 396	$ 420
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 293	$ (1,663)	$ 331	$ 352	$ 373	$ 396	$ 420
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 293**	**$ (1,663)**	**$ 331**	**$ 352**	**$ 373**	**$ 396**	**$ 420**
Cumulative Cash Flow	**$ 462**	**$ (1,201)**	**$ (870)**	**$ (519)**	**$ (145)**	**$ 251**	**$ 671**

Project Output	**Year 21**	**Year 22**	**Year 23**	**Year 24**	**Year 25**
Scenario B: Taxable Rebate; Pro Forma Project Economics					
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 897	$ 937	$ 979	$ 1,023	$ 1,068
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 897	$ 937	$ 979	$ 1,023	$ 1,068
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 445	$ 472	$ 500	$ 529	$ 560
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 445	$ 472	$ 500	$ 529	$ 560
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 445	$ 472	$ 500	$ 529	$ 560
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate					
Net Income	**$ 445**	**$ 472**	**$ 500**	**$ 529**	**$ 560**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 445	$ 472	$ 500	$ 529	$ 560
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 445	$ 472	$ 500	$ 529	$ 560
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 445**	**$ 472**	**$ 500**	**$ 529**	**$ 560**
Cumulative Cash Flow	**$ 1,116**	**$ 1,588**	**$ 2,088**	**$ 2,617**	**$ 3,177**

MAINTENANCE SHOPS

Table 37: Maintenance Shops PV Profile

Building	
Building Name	Maintenance Shops
Building Address	112 Southampton Street Boston, MA
City Department	Boston Transportation Department
Number of floors	
Square footage (if known)	
Fuel Type(s)	
Contact Information	
Facilities Manager	Paul McColgan
Phone	(617) 635-2072
Email	
Electrical Connection	
Electric Utility Company	
Floor Plan showing Electrical room	Yes / No
Roof Details	
Roof slope/angle (Flat = 0^{o})	
Roof Orientation (S, SE, SW, etc.)	
Roof Size – Square Feet	
Roof Condition: poor, fair, good, excellent, new	
Roof Type (asphalt, shingles, rubber membrane, etc.)	
Expected life of roof (years)	
Equipment/obstructions on the roof	If Yes, please describe briefly
Detailed Roof Drawings available	Yes / No

Table 38: Maintenance Shops Summary of Findings

Summary of Findings	
Suited for Solar Water Heating?	No
Site Efficiency	91.00%
Area of roof available for panel installation	11172 sq ft
Maximum number of panels that can be installed	696
DC Output of maximum number of panels	21050 W
Net Capacity Factor (%)	12.4%
Cost of Installation:	

Figure 35: Maintenance Shops Solar Pathfinder Report

WPI Solar Team and Solar Boston Site Report

Report Name	112 Southampton
Report Date	4/16/2008 9:13:36 AM
Declination	-15d 12m
Location	BOSTON, MA, Zipcode: 02118
Lat/Long	42.336 / -71.073
Weather Station	Boston, MA, Elevation: 6 m
Site distance	1.01 miles
Array Type	Fixed
Tilt Angle	42.34 deg
Ideal Tilt Angle	43.00 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Make	Evergreen Solar
Panel Model	ES-195-RL
Panel Count	696
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	Custom
Layout Point Count	4

Notes: [None]
City of Boston Environment Department
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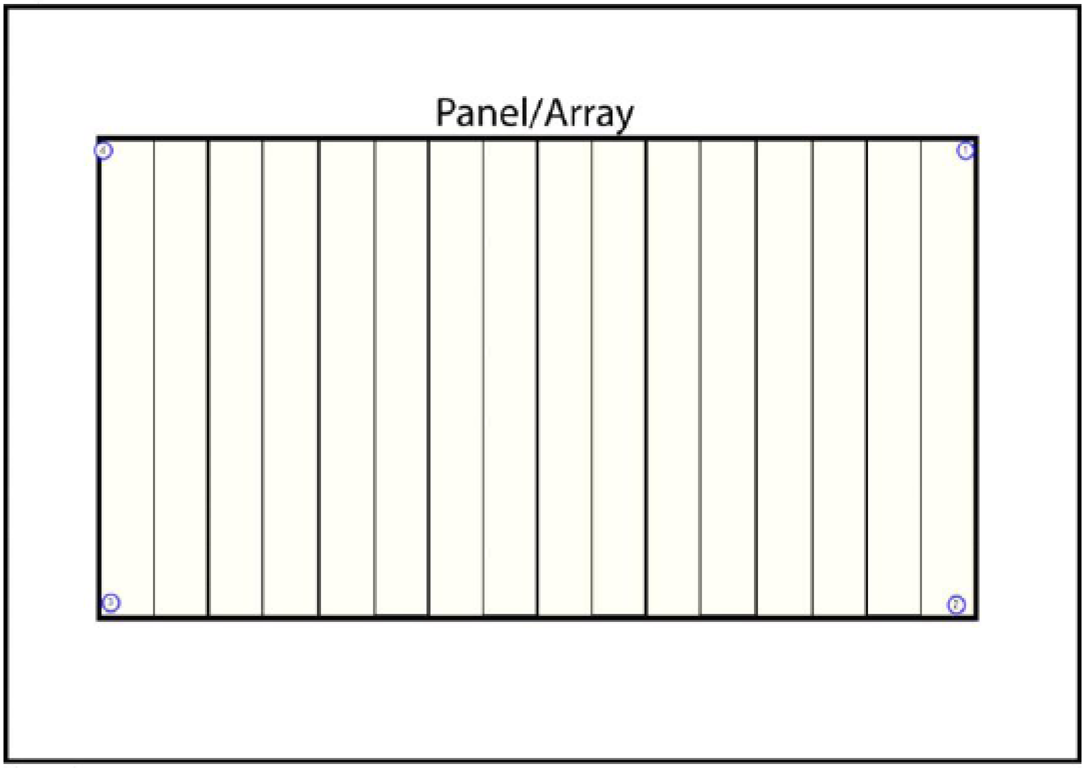
WPI Solar Team and Solar Boston System Picture Layout

Layout Type Custom
Layout Point Count 4



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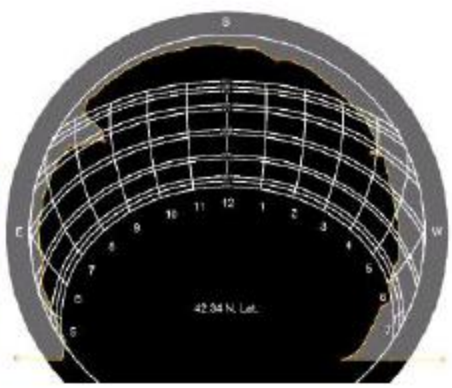
WPI Solar Team and Solar E2st
Solar Site Analysis Report

Image File solar 041.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.34	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.34 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	94.00%	2.35	8642.00	8342.84
February	92.00%	3.05	10197.00	9521.91
March	98.00%	4.12	14215.00	14075.31
April	99.00%	4.45	14137.00	14104.80
May	99.00%	5.06	16132.00	16102.92
June	100.00%	5.67	16884.00	16869.71
July	100.00%	5.33	16268.00	16251.81
August	99.00%	4.99	15484.00	15416.75
September	98.00%	5.05	15709.00	15555.97
October	95.00%	3.66	12355.00	11860.16
November	92.00%	2.53	8853.00	8312.43
December	94.00%	2.20	8105.00	7734.76
Totals	**96.58%**	**48.47**	**156981.0**	**154149.37**
	Unweighted Yearly Avg	**Effect: 97.27% Sun Hrs: 4.04**		

Notes: [None]



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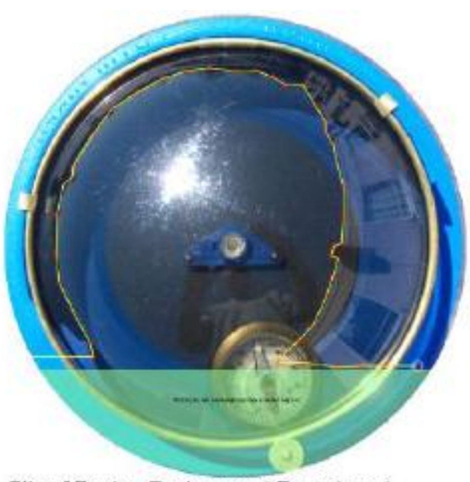
WPI Solar Team and Solar E 1 st
Solar Site Analysis Report

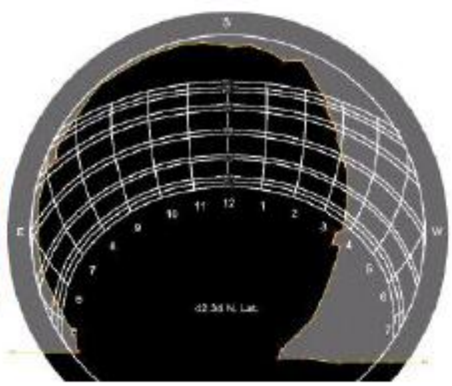
Image File solar 040.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.34	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.34 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	85.00%	2.12	8642.00	7511.60
February	86.00%	2.85	10197.00	8846.55
March	90.00%	3.80	14215.00	12996.59
April	90.00%	4.05	14137.00	12930.48
May	91.00%	4.65	16132.00	14983.70
June	90.00%	5.16	16884.00	15552.73
July	91.00%	4.86	16268.00	15014.63
August	91.00%	4.61	15484.00	14359.91
September	91.00%	4.70	15709.00	14528.22
October	89.00%	3.43	12355.00	11104.91
November	88.00%	2.41	8853.00	7911.40
December	88.00%	2.07	8105.00	7282.86
Totals	**89.24%**	**44.70**	**156981.0**	**143023.58**
	Unweighted Yearly Avg	**Effect: 89.70% Sun Hrs: 3.73**		

Notes: [None]





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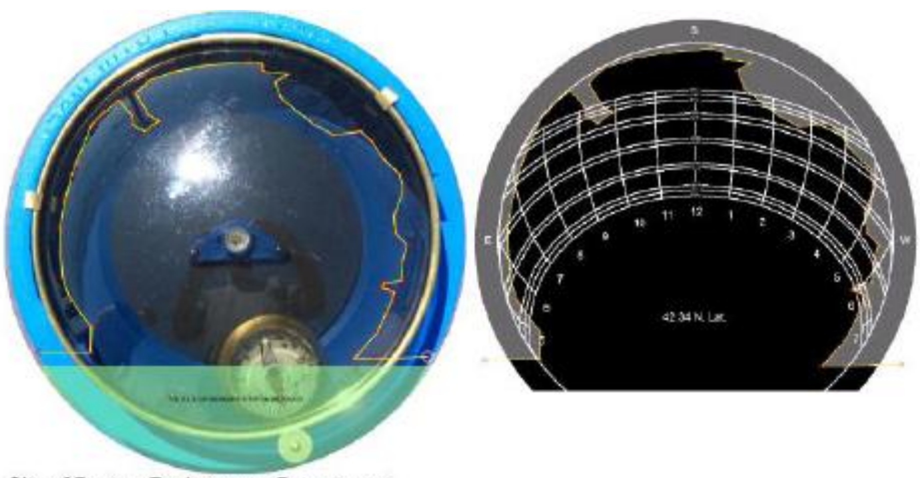
WPI Solar Team and Solar E3st
Solar Site Analysis Report

Image File solar 043.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.34	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.34 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	69.00%	1.71	8642.00	6046.90
February	99.00%	3.28	10197.00	10143.80
March	99.00%	4.16	14215.00	14180.51
April	100.00%	4.48	14137.00	14129.88
May	99.00%	5.06	16132.00	16122.22
June	99.00%	5.65	16884.00	16836.92
July	99.00%	5.32	16268.00	16250.71
August	99.00%	5.02	15484.00	15471.39
September	99.00%	5.08	15709.00	15628.76
October	99.00%	3.83	12355.00	12326.13
November	76.00%	2.10	8853.00	6832.02
December	70.00%	1.65	8105.00	5801.17
Totals	**92.30%**	**47.35**	**156981.0**	**149770.4**
	Unweighted Yearly Avg	**Effect: 95.02% Sun Hrs: 3.95**		

s **Notes:** [None]



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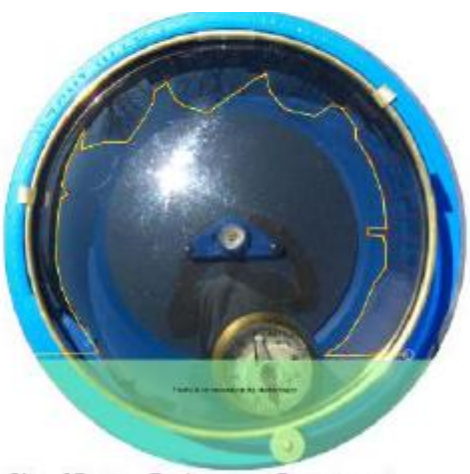
WPI Solar Team and Solar E 4 st
Solar Site Analysis Report

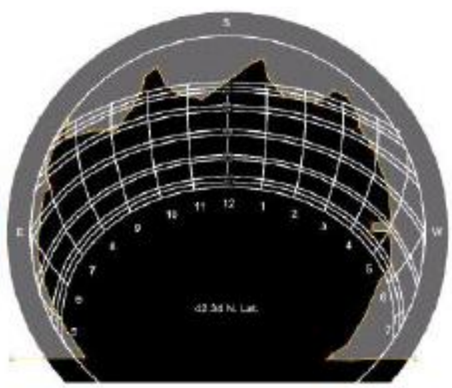
Image File solar 045.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.34	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.34 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	51.00%	1.28	8642.00	4561.39
February	91.00%	3.01	10197.00	9340.66
March	97.00%	4.10	14215.00	14009.39
April	98.00%	4.42	14137.00	14058.98
May	99.00%	5.04	16132.00	16069.99
June	99.00%	5.63	16884.00	16812.20
July	99.00%	5.30	16268.00	16210.12
August	97.00%	4.92	15484.00	15265.91
September	98.00%	5.03	15709.00	15501.38
October	96.00%	3.72	12355.00	12043.43
November	68.00%	1.88	8853.00	6157.82
December	38.00%	0.89	8105.00	3117.22
Totals	**85.96%**	**45.21**	**156981.0**	**143148.51**
	Unweighted Yearly Avg	**Effect: 90.71% Sun Hrs: 3.77**		

Notes: [None]





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WPI Solar Team and Solar Bost Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.34	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.34 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	74.75%	1.87	8642.00	6615.68
February	92.00%	3.05	10197.00	9463.23
March	96.00%	4.05	14215.00	13815.45
April	96.75%	4.35	14137.00	13806.04
May	97.00%	4.95	16132.00	15819.71
June	97.00%	5.53	16884.00	16517.89
July	97.25%	5.20	16268.00	15931.82
August	96.50%	4.89	15484.00	15128.49
September	96.50%	4.97	15709.00	15303.58
October	94.75%	3.66	12355.00	11833.66
November	81.00%	2.23	8853.00	7303.42
December	72.50%	1.70	8105.00	5984.00
Totals	**91.00%**	**48.47**	**156981.0**	**147522.96**
	Unweighted Yearly Avg	**Effect: 93.18% Sun Hrs: 3.87**		

Notes: [None]

City of Boston Environment Department

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Table 39: Maintenance Shops MTC Rebate Estimator Summary

Commonwealth Solar Non-Residential Solar Photovoltaic Calculator

Non-Residential: Commonwealth Solar Rebate Matrix ($/watt dc)				
Incremental Capacity	**1 to 25 kW** (1,000 to 25,000 watts)	**> 25 to 100 kW**	**> 100 kW to 200 kW**	**> 200 kW to 500 kW**
Base Incentive ($/watt dc)	$3.25	$2.50	$2.00	$1.50
PLUS: Additions to Base				
MA-Manufactured Components	$0.25	$0.25	$0.25	$0.25
Public Building Adder	$0.50	$0.50	$0.25	$0.25

Non-Residential: Commonwealth Solar Rebate Calculator	
Total PV Project Size (watts dc)	**21,050**
Total PV Project Size for Rebate Calculation (500 kW cap)	**21,050**
MA-manufactured components	YES
Public Building Adder	YES
Rebate ($)	**$ 84,200.00**
Rebate ($/watt dc) based on total project size	**$ 4.00000**
Key	
Entry Cells	
Calculation Cells (not for Entry)	

Click here for Financial Model

DATA ENTRY AND FINANCIAL SUMMARY

Key

Entry Cells		
Cells Draw Data from Another Worksheet		
Calculation Cells (Not for Entry)		
Select Taxable or Non-Taxable Entity	Non-Taxable	
Project and Customer Cost Assumptions		
Solar Photovoltaic System Size	21,050	Watts (DC STC)
Total System Cost/Watt	$ 7.00	$/Watt (DC STC)
Total System Cost	$ 147,350	
MTC Rebate Assumptions		
MTC Scenario A: Non-Taxable Rebate	$ 4.000	$/Watt (DC STC)
Scenario A Rebate	$ 84,200	
MTC Scenario B: Taxable Rebate	$ 4.182	$/Watt (DC STC)
Scenario B Rebate	$ 88,031	
Project Performance and Savings/ Cost Assumptions		
Annual Net Capacity Factor	12.4%	kW (DC STC) to kWh AC
Annual Production Degradation	0.50%	%
Project Life	25	Years
Electricity Revenue (Avoided Costs)	$ 0.15	$/kWh
Electricity Revenue (Avoided Costs) Annual Adjustor	5.0%	%
Renewable Energy Certificate (REC) Revenue	$ 0.03	$/kWh
REC Revenue Annual Adjustor	0.0%	%
REC Revenue Term	3	Years (must be equal to or less thar
Annual Operations and Maintenance Cost	$ 250	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.75	$/Watt (DC STC)
Inverter Life, Replace Every X Years	15	Year (must be equal to or less than

Scenario Definitions

Scenario A: Non-Taxable Rebate - Assumes that the state rebate is non-taxable, but is subtracted from the cost basis for purposes of determi

Scenario B: Taxable Rebate - Assumes that the state rebate is taxable, but is not subtracted from the cost basis for purposes of determining t

Both Scenarios assume that the project owner can use both federal and state tax benefits

Tax Assumptions

Federal Tax Rate	0%					
State Tax Rate	0%					
Effective Tax Rate	0%					
Federal Tax Credit	0%					
State Tax Deduction	0%					
5 Year Accelerated Depreciation Schedule (MACRS)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Financing Assumptions

% Financed w/ Cash	100%	
% Financed w/ Loan	0%	
Loan Interest Rate	8%	
Loan Period	20	Years (must be equal to or less than project life)
Scenario A Net Cost	$ 63,150	
Scenario A Loan	$ -	
Scenario B Net Cost	$ 59,319	
Scenario B Loan	$ -	
Customer Discount Rate	6%	

Solar Project Financial Analysis Summary

Scenario A: Net Present Value	**$ (3,829)**
Scenario A: Simple Payback (100% Cash only)	**Year 17**
Scenario A: Estimated Return on Equity	**#DIV/0!**
Scenario A: Guess Return on Equity	50%
Scenario B: Net Present Value	**$ 2**
Scenario B: Simple Payback (100% Cash only)	**Year 14**
Scenario B: Estimated Return on Equity	**#DIV/0!**
Scenario B: Guess Return on Equity	50%

PRO FORMA AND PRODUCTION

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Annual Generation (kWh)		22,865	22,751	22,637	22,524	22,411	22,299

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 3,430	$ 3,583	$ 3,744	$ 3,911	$ 4,086	$ 4,269
REC Revenue		$ 686	$ 683	$ 679	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 4,116	$ 4,266	$ 4,423	$ 3,911	$ 4,086	$ 4,269
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 3,866	$ 4,008	$ 4,158	$ 3,638	$ 3,805	$ 3,979
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 3,866	$ 4,008	$ 4,158	$ 3,638	$ 3,805	$ 3,979
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 3,866	$ 4,008	$ 4,158	$ 3,638	$ 3,805	$ 3,979
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Net Income		**$ 3,866**	**$ 4,008**	**$ 4,158**	**$ 3,638**	**$ 3,805**	**$ 3,979**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 3,866	$ 4,008	$ 4,158	$ 3,638	$ 3,805	$ 3,979
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 3,866	$ 4,008	$ 4,158	$ 3,638	$ 3,805	$ 3,979
Cash From Investing							
Installed PV Cost	$ (63,150)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (63,150)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ (63,150)**	**$ 3,866**	**$ 4,008**	**$ 4,158**	**$ 3,638**	**$ 3,805**	**$ 3,979**
Cumulative Cash Flow	**$ (63,150)**	**$ (59,284)**	**$ (55,276)**	**$ (51,118)**	**$ (47,480)**	**$ (43,676)**	**$ (39,696)**

PRO FORMA AND PRODUCTION

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Annual Generation (kWh)	22,188	22,077	21,967	21,857	21,747	21,639	21,531

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 4,460	$ 4,660	$ 4,868	$ 5,086	$ 5,314	$ 5,551	$ 5,800
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 4,460	$ 4,660	$ 4,868	$ 5,086	$ 5,314	$ 5,551	$ 5,800
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 4,162	$ 4,352	$ 4,552	$ 4,760	$ 4,978	$ 5,205	$ 5,443
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 4,162	$ 4,352	$ 4,552	$ 4,760	$ 4,978	$ 5,205	$ 5,443
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 4,162	$ 4,352	$ 4,552	$ 4,760	$ 4,978	$ 5,205	$ 5,443
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 4,162**	**$ 4,352**	**$ 4,552**	**$ 4,760**	**$ 4,978**	**$ 5,205**	**$ 5,443**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 4,162	$ 4,352	$ 4,552	$ 4,760	$ 4,978	$ 5,205	$ 5,443
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 4,162	$ 4,352	$ 4,552	$ 4,760	$ 4,978	$ 5,205	$ 5,443
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 4,162**	**$ 4,352**	**$ 4,552**	**$ 4,760**	**$ 4,978**	**$ 5,205**	**$ 5,443**
Cumulative Cash Flow	**$ (35,535)**	**$ (31,183)**	**$ (26,631)**	**$ (21,871)**	**$ (16,894)**	**$ (11,688)**	**$ (6,245)**

PRO FORMA AND PRODUCTION

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Annual Generation (kWh)	21,423	21,316	21,209	$ 21,103	20,998	20,893	20,788

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 6,059	$ 6,331	$ 6,614	$ 6,910	$ 7,219	$ 7,542	$ 7,880
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 6,059	$ 6,331	$ 6,614	$ 6,910	$ 7,219	$ 7,542	$ 7,880
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (15,788)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (16,166)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 5,692	$ (9,835)	$ 6,224	$ 6,509	$ 6,806	$ 7,116	$ 7,441
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 5,692	$ (9,835)	$ 6,224	$ 6,509	$ 6,806	$ 7,116	$ 7,441
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 5,692	$ (9,835)	$ 6,224	$ 6,509	$ 6,806	$ 7,116	$ 7,441
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 5,692**	**$ (9,835)**	**$ 6,224**	**$ 6,509**	**$ 6,806**	**$ 7,116**	**$ 7,441**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 5,692	$ (9,835)	$ 6,224	$ 6,509	$ 6,806	$ 7,116	$ 7,441
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 5,692	$ (9,835)	$ 6,224	$ 6,509	$ 6,806	$ 7,116	$ 7,441
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 5,692**	**$ (9,835)**	**$ 6,224**	**$ 6,509**	**$ 6,806**	**$ 7,116**	**$ 7,441**
Cumulative Cash Flow	**$ (552)**	**$ (10,388)**	**$ (4,163)**	**$ 2,345**	**$ 9,151**	**$ 16,268**	**$ 23,709**

PRO FORMA AND PRODUCTION

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Annual Generation (kWh)	20,684	20,581	20,478	20,376	20,274

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 21	Year 22	Year 23	Year 24	Year 25
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 8,232	$ 8,601	$ 8,985	$ 9,388	$ 9,808
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 8,232	$ 8,601	$ 8,985	$ 9,388	$ 9,808
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 7,781	$ 8,136	$ 8,506	$ 8,894	$ 9,299
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 7,781	$ 8,136	$ 8,506	$ 8,894	$ 9,299
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 7,781	$ 8,136	$ 8,506	$ 8,894	$ 9,299
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 7,781**	**$ 8,136**	**$ 8,506**	**$ 8,894**	**$ 9,299**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 7,781	$ 8,136	$ 8,506	$ 8,894	$ 9,299
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 7,781	$ 8,136	$ 8,506	$ 8,894	$ 9,299
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 7,781**	**$ 8,136**	**$ 8,506**	**$ 8,894**	**$ 9,299**
Cumulative Cash Flow	**$ 31,490**	**$ 39,625**	**$ 48,132**	**$ 57,026**	**$ 66,325**

Project Output	**Start-Up 0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 3,430	$ 3,583	$ 3,744	$ 3,911	$ 4,086	$ 4,269
REC Revenue		$ 686	$ 683	$ 679	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 4,116	$ 4,266	$ 4,423	$ 3,911	$ 4,086	$ 4,269
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 3,866	$ 4,008	$ 4,158	$ 3,638	$ 3,805	$ 3,979
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 3,866	$ 4,008	$ 4,158	$ 3,638	$ 3,805	$ 3,979
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 3,866	$ 4,008	$ 4,158	$ 3,638	$ 3,805	$ 3,979
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate		$ -					
Net Income		**$ 3,866**	**$ 4,008**	**$ 4,158**	**$ 3,638**	**$ 3,805**	**$ 3,979**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 3,866	$ 4,008	$ 4,158	$ 3,638	$ 3,805	$ 3,979
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 3,866	$ 4,008	$ 4,158	$ 3,638	$ 3,805	$ 3,979
Cash From Investing							
Installed PV Cost	$ (59,319)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (59,319)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ (59,319)**	**$ 3,866**	**$ 4,008**	**$ 4,158**	**$ 3,638**	**$ 3,805**	**$ 3,979**
Cumulative Cash Flow	**$ (59,319)**	**$ (55,453)**	**$ (51,445)**	**$ (47,287)**	**$ (43,649)**	**$ (39,844)**	**$ (35,865)**

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 4,460	$ 4,660	$ 4,868	$ 5,086	$ 5,314	$ 5,551	$ 5,800
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 4,460	$ 4,660	$ 4,868	$ 5,086	$ 5,314	$ 5,551	$ 5,800
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 4,162	$ 4,352	$ 4,552	$ 4,760	$ 4,978	$ 5,205	$ 5,443
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 4,162	$ 4,352	$ 4,552	$ 4,760	$ 4,978	$ 5,205	$ 5,443
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 4,162	$ 4,352	$ 4,552	$ 4,760	$ 4,978	$ 5,205	$ 5,443
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 4,162**	**$ 4,352**	**$ 4,552**	**$ 4,760**	**$ 4,978**	**$ 5,205**	**$ 5,443**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 4,162	$ 4,352	$ 4,552	$ 4,760	$ 4,978	$ 5,205	$ 5,443
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 4,162	$ 4,352	$ 4,552	$ 4,760	$ 4,978	$ 5,205	$ 5,443
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 4,162**	**$ 4,352**	**$ 4,552**	**$ 4,760**	**$ 4,978**	**$ 5,205**	**$ 5,443**
Cumulative Cash Flow	**$ (31,704)**	**$ (27,351)**	**$ (22,800)**	**$ (18,040)**	**$ (13,062)**	**$ (7,857)**	**$ (2,414)**

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 6,059	$ 6,331	$ 6,614	$ 6,910	$ 7,219	$ 7,542	$ 7,880
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 6,059	$ 6,331	$ 6,614	$ 6,910	$ 7,219	$ 7,542	$ 7,880
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (15,788)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (16,166)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 5,692	$ (9,835)	$ 6,224	$ 6,509	$ 6,806	$ 7,116	$ 7,441
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 5,692	$ (9,835)	$ 6,224	$ 6,509	$ 6,806	$ 7,116	$ 7,441
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 5,692	$ (9,835)	$ 6,224	$ 6,509	$ 6,806	$ 7,116	$ 7,441
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 5,692**	**$ (9,835)**	**$ 6,224**	**$ 6,509**	**$ 6,806**	**$ 7,116**	**$ 7,441**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 5,692	$ (9,835)	$ 6,224	$ 6,509	$ 6,806	$ 7,116	$ 7,441
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 5,692	$ (9,835)	$ 6,224	$ 6,509	$ 6,806	$ 7,116	$ 7,441
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 5,692**	**$ (9,835)**	**$ 6,224**	**$ 6,509**	**$ 6,806**	**$ 7,116**	**$ 7,441**
Cumulative Cash Flow	**$ 3,279**	**$ (6,556)**	**$ (332)**	**$ 6,177**	**$ 12,982**	**$ 20,099**	**$ 27,540**

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Scenario B: Taxable Rebate; Pro Forma Project Economics					
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 8,232	$ 8,601	$ 8,985	$ 9,388	$ 9,808
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 8,232	$ 8,601	$ 8,985	$ 9,388	$ 9,808
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 7,781	$ 8,136	$ 8,506	$ 8,894	$ 9,299
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 7,781	$ 8,136	$ 8,506	$ 8,894	$ 9,299
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 7,781	$ 8,136	$ 8,506	$ 8,894	$ 9,299
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate					
Net Income	**$ 7,781**	**$ 8,136**	**$ 8,506**	**$ 8,894**	**$ 9,299**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 7,781	$ 8,136	$ 8,506	$ 8,894	$ 9,299
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 7,781	$ 8,136	$ 8,506	$ 8,894	$ 9,299
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 7,781**	**$ 8,136**	**$ 8,506**	**$ 8,894**	**$ 9,299**
Cumulative Cash Flow	**$ 35,321**	**$ 43,456**	**$ 51,963**	**$ 60,857**	**$ 70,156**

WEST ROXBURY LIBRARY

Table 40: West Roxbury Library PV Profile

Building	
Building Name	West Roxbury Library
Building Address	1961 Centre Street Boston, MA
City Department	Boston Public Libraries
Number of floors	5
Square footage (if known)	12357sq-ft
Fuel Type(s)	
Contact Information	
Facilities Manager	Jim Meade
Phone	(617) 974-7440
Email	JMeade@bpl.org
Electrical Connection	
Electric Utility Company	NStar
Floor Plan showing Electrical room	Yes / No
Roof Details	
Roof slope/angle (Flat = 0°)	0°
Roof Orientation (S, SE, SW, etc.)	Flat
Roof Size – Square Feet	12357.71 sq ft
Roof Condition: poor, fair, good, excellent, new	Good
Roof Type (asphalt, shingles, rubber membrane, etc.)	Asphalt
Expected life of roof (years)	3 – 5 years
Equipment/obstructions on the roof	A few obstructions due to equipment but still fine
Detailed Roof Drawings available	Yes / No

Table 41: West Roxbury Library Summary of Findings

Summary of Findings	
Suited for Solar Water Heating?	No
Shading on Roof (%)	86.65%
Area of roof available for panel installation	40% of total roof area
Maximum number of panels that can be installed	308
DC Output of maximum number of panels	8,670W
Net Capacity Factor (%)	11.5%
Cost of Installation:	$26,280

Figure 36: West Roxbury Library Solar Pathfinder Report

WPI Solar Team and Solar Boston Site Report

Report Name	WR LIBRARY
Report Date	4/22/2008 2:34:00 PM
Declination	-15d 08m
Location	WEST ROXBURY, MA, Zipcode: 02132
Lat/Long	42.278 / -71.156
Weather Station	Boston, MA, Elevation: 6 m
Site distance	6.76 miles
Array Type	Fixed
Tilt Angle	42.28 deg
Ideal Tilt Angle	43.00 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Make	Evergreen Solar
Panel Model	ES-195-RL
Panel Count	1
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	Custom
Layout Point Count	2

Notes: [None]
Report generated by SolarPathfinder Assistant Version 3.0.7.0. http://www.solarpathfinder.com
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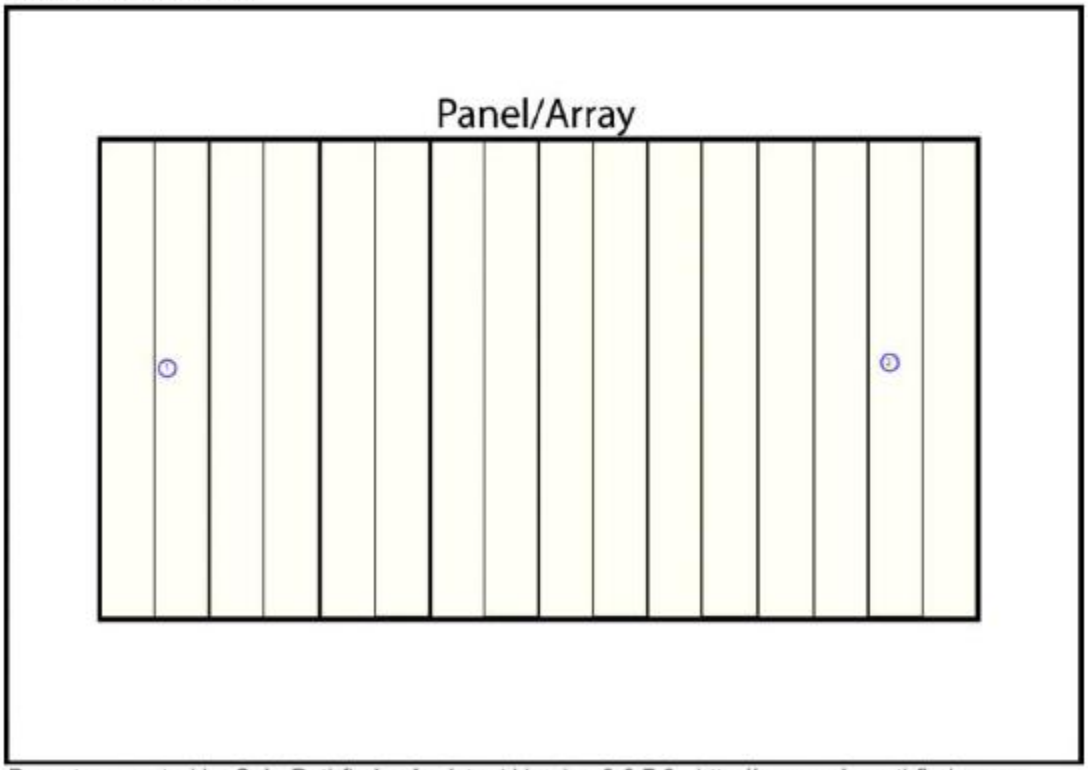
WPI Solar Team and Solar Boston System Picture Layout

Layout Type Custom
Layout Point Count 2



Report generated by SolarPathfinder Assistant Version 3.0.7.0. http://www.solarpathfinder.com
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WPI Solar Team and Solar E 1 st
Solar Site Analysis Report

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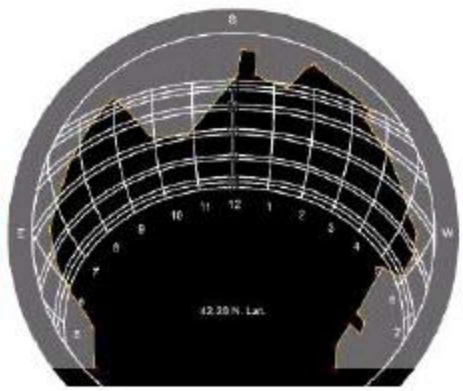
Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.28	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.28 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	57.00%	1.43	12.00	6.97
February	67.00%	2.24	14.00	9.99
March	91.00%	3.84	21.00	19.34
April	99.00%	4.45	20.00	20.00
May	99.00%	5.02	24.00	23.96
June	98.00%	5.56	24.00	24.00
July	99.00%	5.30	23.00	23.00
August	99.00%	4.98	22.00	22.00
September	97.00%	5.01	22.00	21.91
October	71.00%	2.74	18.00	12.50
November	53.00%	1.47	13.00	7.15
December	41.00%	0.97	12.00	4.95
Totals	**80.95%**	**43.00**	**225.0**	**195.77**
	Unweighted Yearly Avg	**Effect: 86.29% Sun Hrs: 3.58**		

Notes: [None]



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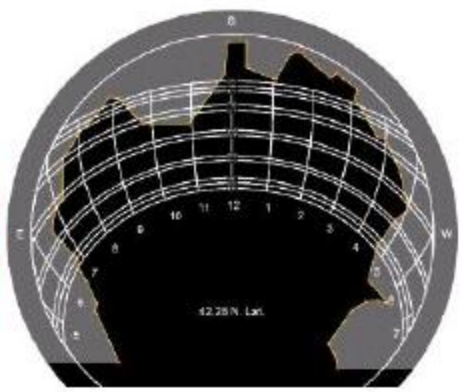
WPI Solar Team and Solar B[illegible]st
Solar Site Analysis Report

Image File WR Library2.JPG

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.28	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.28 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	63.00%	1.57	12.00	7.57
February	75.00%	2.49	14.00	10.89
March	97.00%	4.07	21.00	20.57
April	96.00%	4.34	20.00	19.81
May	94.00%	4.78	24.00	22.95
June	93.00%	5.31	24.00	23.11
July	94.00%	5.06	23.00	22.77
August	96.00%	4.83	22.00	21.81
September	96.00%	4.96	22.00	21.78
October	79.00%	3.03	18.00	13.87
November	60.00%	1.65	13.00	8.05
December	54.00%	1.27	12.00	6.40
Totals	**83.08%**	**43.36**	**225.0**	**199.58**
	Unweighted Yearly Avg	**Effect: 87.00% Sun Hrs: 3.61**		

Notes: [None]



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WPI Solar Team and Solar Bost Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.28	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.28 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	60.00%	1.50	12.00	7.27
February	71.00%	2.37	14.00	10.44
March	94.00%	3.96	21.00	19.96
April	97.50%	4.40	20.00	19.91
May	96.50%	4.90	24.00	23.46
June	95.50%	5.44	24.00	23.56
July	96.50%	5.18	23.00	22.89
August	97.50%	4.91	22.00	21.91
September	96.50%	4.99	22.00	21.85
October	75.00%	2.89	18.00	13.19
November	56.50%	1.56	13.00	7.60
December	47.50%	1.12	12.00	5.68
Totals	**82.00%**	**43.00**	**225.0**	**197.68**
	Unweighted Yearly Avg	**Effect: 86.65% Sun Hrs: 3.60**		

Notes: [None]

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Table 42: West Roxbury Library MTC Rebate Estimator Summary

Commonwealth Solar Non-Residential Solar Photovoltaic Calculator

Non-Residential: Commonwealth Solar Rebate Matrix ($/watt dc)				
Incremental Capacity	**1 to 25 kW** (1,000 to 25,000 watts)	**> 25 to 100 kW**	**> 100 kW to 200 kW**	**> 200 kW to 500 kW**
Base Incentive ($/watt dc)	$3.25	$2.50	$2.00	$1.50
PLUS: Additions to Base				
MA-Manufactured Components	$0.25	$0.25	$0.25	$0.25
Public Building Adder	$0.50	$0.50	$0.25	$0.25

Non-Residential: Commonwealth Solar Rebate Calculator	
Total PV Project Size (watts dc)	**8,760**
Total PV Project Size for Rebate Calculation (500 kW cap)	**8,760**
MA-manufactured components	YES
Public Building Adder	YES
Rebate ($)	**$ 35,040.00**
Rebate ($/watt dc) based on total project size	**$ 4.00000**

Click here for Financial Model

Key

Entry Cells	(green)
Calculation Cells (not for Entry)	(yellow)

DATA ENTRY AND FINANCIAL SUMMARY

Key

Entry Cells	(green)
Cells Draw Data from Another Worksheet	(yellow)
Calculation Cells (Not for Entry)	(white)

Select Taxable or Non-Taxable Entity — Non-Taxable

Project and Customer Cost Assumptions

Solar Photovoltaic System Size	8,760	Watts (DC STC)
Total System Cost/Watt	$ 7.00	$/Watt (DC STC)
Total System Cost	$ 61,320	

MTC Rebate Assumptions

MTC Scenario A: Non-Taxable Rebate	$ 4.000	$/Watt (DC STC)
Scenario A Rebate	$ 35,040	
MTC Scenario B: Taxable Rebate	$ 4.710	$/Watt (DC STC)
Scenario B Rebate	$ 41,260	

Project Performance and Savings/ Cost Assumptions

Annual Net Capacity Factor	11.5%	kW (DC STC) to kWh AC
Annual Production Degradation	0.50%	%
Project Life	25	Years
Electricity Revenue (Avoided Costs)	$ 0.15	$/kWh
Electricity Revenue (Avoided Costs) Annual Adjustor	5.0%	%
Renewable Energy Certificate (REC) Revenue	$ 0.03	$/kWh
REC Revenue Annual Adjustor	0.0%	%
REC Revenue Term	3	Years (must be equal to or less than project life)
Annual Operations and Maintenance Cost	$ 250	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.75	$/Watt (DC STC)
Inverter Life, Replace Every X Years	15	Year (must be equal to or less than project life)

Scenario Definitions

Scenario A: Non-Taxable Rebate - Assumes that the state rebate is non-taxable, but is subtracted from the cost basis for purposes of

Scenario B: Taxable Rebate - Assumes that the state rebate is taxable, but is not subtracted from the cost basis for purposes of deter

Both Scenarios assume that the project owner can use both federal and state tax benefits

Tax Assumptions

Federal Tax Rate	0%					
State Tax Rate	0%					
Effective Tax Rate	0%					
Federal Tax Credit	0%					
State Tax Deduction	0%					
5 Year Accelerated Depreciation Schedule (MACRS)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Financing Assumptions

% Financed w/ Cash	100%	
% Financed w/ Loan	0%	
Loan Interest Rate	8%	
Loan Period	20	Years (must be equal to or less than project life)
Scenario A Net Cost	$ 26,280	
Scenario A Loan	$ -	
Scenario B Net Cost	$ 20,060	
Scenario B Loan	$ -	
Customer Discount Rate	6%	

Solar Project Financial Analysis Summary	
Scenario A: Net Present Value	**$ (6,205)**
Scenario A: Simple Payback (100% Cash only)	**Year 19**
Scenario A: Estimated Return on Equity	**#DIV/0!**
Scenario A: Guess Return on Equity	50%
Scenario B: Net Present Value	**$ 15**
Scenario B: Simple Payback (100% Cash only)	**Year 14**
Scenario B: Estimated Return on Equity	**#DIV/0!**
Scenario B: Guess Return on Equity	50%

PRO FORMA AND PRODUCTION

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Annual Generation (kWh)		8,825	8,781	8,737	8,693	8,650	8,606

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

INCOME STATEMENT	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Electricity Revenue (Avoided Cost)		$ 1,324	$ 1,383	$ 1,445	$ 1,510	$ 1,577	$ 1,648
REC Revenue		$ 265	$ 263	$ 262	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 1,588	$ 1,646	$ 1,707	$ 1,510	$ 1,577	$ 1,648
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 1,338	$ 1,389	$ 1,442	$ 1,236	$ 1,296	$ 1,358
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 1,338	$ 1,389	$ 1,442	$ 1,236	$ 1,296	$ 1,358
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 1,338	$ 1,389	$ 1,442	$ 1,236	$ 1,296	$ 1,358
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Net Income		**$ 1,338**	**$ 1,389**	**$ 1,442**	**$ 1,236**	**$ 1,296**	**$ 1,358**

CASH FLOW STATEMENT	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Cash From Operations							
Net Income		$ 1,338	$ 1,389	$ 1,442	$ 1,236	$ 1,296	$ 1,358
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 1,338	$ 1,389	$ 1,442	$ 1,236	$ 1,296	$ 1,358
Cash From Investing							
Installed PV Cost	$ (26,280)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (26,280)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ (26,280)**	**$ 1,338**	**$ 1,389**	**$ 1,442**	**$ 1,236**	**$ 1,296**	**$ 1,358**
Cumulative Cash Flow	**$ (26,280)**	**$ (24,942)**	**$ (23,553)**	**$ (22,111)**	**$ (20,875)**	**$ (19,579)**	**$ (18,221)**

PRO FORMA AND PRODUCTION

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Annual Generation (kWh)	8,563	8,521	8,478	8,436	8,393	8,351	8,310

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 1,721	$ 1,798	$ 1,879	$ 1,963	$ 2,051	$ 2,143	$ 2,238
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,721	$ 1,798	$ 1,879	$ 1,963	$ 2,051	$ 2,143	$ 2,238
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 1,423	$ 1,491	$ 1,562	$ 1,637	$ 1,715	$ 1,797	$ 1,882
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 1,423	$ 1,491	$ 1,562	$ 1,637	$ 1,715	$ 1,797	$ 1,882
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 1,423	$ 1,491	$ 1,562	$ 1,637	$ 1,715	$ 1,797	$ 1,882
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 1,423**	**$ 1,491**	**$ 1,562**	**$ 1,637**	**$ 1,715**	**$ 1,797**	**$ 1,882**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 1,423	$ 1,491	$ 1,562	$ 1,637	$ 1,715	$ 1,797	$ 1,882
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 1,423	$ 1,491	$ 1,562	$ 1,637	$ 1,715	$ 1,797	$ 1,882
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 1,423**	**$ 1,491**	**$ 1,562**	**$ 1,637**	**$ 1,715**	**$ 1,797**	**$ 1,882**
Cumulative Cash Flow	**$ (16,798)**	**$ (15,307)**	**$ (13,745)**	**$ (12,108)**	**$ (10,394)**	**$ (8,597)**	**$ (6,715)**

PRO FORMA AND PRODUCTION

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Annual Generation (kWh)	8,268	8,227	8,186	$ 8,145	8,104	8,063	8,023

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 2,339	$ 2,443	$ 2,553	$ 2,667	$ 2,786	$ 2,911	$ 3,041
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 2,339	$ 2,443	$ 2,553	$ 2,667	$ 2,786	$ 2,911	$ 3,041
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (6,570)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (6,948)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 1,971	$ (4,505)	$ 2,163	$ 2,266	$ 2,373	$ 2,485	$ 2,603
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 1,971	$ (4,505)	$ 2,163	$ 2,266	$ 2,373	$ 2,485	$ 2,603
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 1,971	$ (4,505)	$ 2,163	$ 2,266	$ 2,373	$ 2,485	$ 2,603
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 1,971**	**$ (4,505)**	**$ 2,163**	**$ 2,266**	**$ 2,373**	**$ 2,485**	**$ 2,603**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 1,971	$ (4,505)	$ 2,163	$ 2,266	$ 2,373	$ 2,485	$ 2,603
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 1,971	$ (4,505)	$ 2,163	$ 2,266	$ 2,373	$ 2,485	$ 2,603
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 1,971**	**$ (4,505)**	**$ 2,163**	**$ 2,266**	**$ 2,373**	**$ 2,485**	**$ 2,603**
Cumulative Cash Flow	**$ (4,744)**	**$ (9,249)**	**$ (7,085)**	**$ (4,820)**	**$ (2,447)**	**$ 38**	**$ 2,641**

PRO FORMA AND PRODUCTION

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Annual Generation (kWh)	7,983	7,943	7,903	7,864	7,825

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 21	Year 22	Year 23	Year 24	Year 25
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 3,177	$ 3,319	$ 3,468	$ 3,623	$ 3,785
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 3,177	$ 3,319	$ 3,468	$ 3,623	$ 3,785
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 2,726	$ 2,854	$ 2,989	$ 3,130	$ 3,277
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 2,726	$ 2,854	$ 2,989	$ 3,130	$ 3,277
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 2,726	$ 2,854	$ 2,989	$ 3,130	$ 3,277
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 2,726**	**$ 2,854**	**$ 2,989**	**$ 3,130**	**$ 3,277**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 2,726	$ 2,854	$ 2,989	$ 3,130	$ 3,277
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 2,726	$ 2,854	$ 2,989	$ 3,130	$ 3,277
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 2,726**	**$ 2,854**	**$ 2,989**	**$ 3,130**	**$ 3,277**
Cumulative Cash Flow	**$ 5,367**	**$ 8,221**	**$ 11,210**	**$ 14,340**	**$ 17,617**

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 1,324	$ 1,383	$ 1,445	$ 1,510	$ 1,577	$ 1,648
REC Revenue		$ 265	$ 263	$ 262	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 1,588	$ 1,646	$ 1,707	$ 1,510	$ 1,577	$ 1,648
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 1,338	$ 1,389	$ 1,442	$ 1,236	$ 1,296	$ 1,358
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 1,338	$ 1,389	$ 1,442	$ 1,236	$ 1,296	$ 1,358
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 1,338	$ 1,389	$ 1,442	$ 1,236	$ 1,296	$ 1,358
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate		$ -					
Net Income		**$ 1,338**	**$ 1,389**	**$ 1,442**	**$ 1,236**	**$ 1,296**	**$ 1,358**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 1,338	$ 1,389	$ 1,442	$ 1,236	$ 1,296	$ 1,358
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 1,338	$ 1,389	$ 1,442	$ 1,236	$ 1,296	$ 1,358
Cash From Investing							
Installed PV Cost	$ (20,060)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (20,060)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ (20,060)**	**$ 1,338**	**$ 1,389**	**$ 1,442**	**$ 1,236**	**$ 1,296**	**$ 1,358**
Cumulative Cash Flow	**$ (20,060)**	**$ (18,722)**	**$ (17,333)**	**$ (15,891)**	**$ (14,655)**	**$ (13,359)**	**$ (12,002)**

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 1,721	$ 1,798	$ 1,879	$ 1,963	$ 2,051	$ 2,143	$ 2,238
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,721	$ 1,798	$ 1,879	$ 1,963	$ 2,051	$ 2,143	$ 2,238
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 1,423	$ 1,491	$ 1,562	$ 1,637	$ 1,715	$ 1,797	$ 1,882
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 1,423	$ 1,491	$ 1,562	$ 1,637	$ 1,715	$ 1,797	$ 1,882
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 1,423	$ 1,491	$ 1,562	$ 1,637	$ 1,715	$ 1,797	$ 1,882
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 1,423**	**$ 1,491**	**$ 1,562**	**$ 1,637**	**$ 1,715**	**$ 1,797**	**$ 1,882**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 1,423	$ 1,491	$ 1,562	$ 1,637	$ 1,715	$ 1,797	$ 1,882
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 1,423	$ 1,491	$ 1,562	$ 1,637	$ 1,715	$ 1,797	$ 1,882
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 1,423**	**$ 1,491**	**$ 1,562**	**$ 1,637**	**$ 1,715**	**$ 1,797**	**$ 1,882**
Cumulative Cash Flow	**$ (10,579)**	**$ (9,088)**	**$ (7,526)**	**$ (5,889)**	**$ (4,174)**	**$ (2,378)**	**$ (495)**

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 2,339	$ 2,443	$ 2,553	$ 2,667	$ 2,786	$ 2,911	$ 3,041
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 2,339	$ 2,443	$ 2,553	$ 2,667	$ 2,786	$ 2,911	$ 3,041
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (6,570)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (6,948)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 1,971	$ (4,505)	$ 2,163	$ 2,266	$ 2,373	$ 2,485	$ 2,603
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 1,971	$ (4,505)	$ 2,163	$ 2,266	$ 2,373	$ 2,485	$ 2,603
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 1,971	$ (4,505)	$ 2,163	$ 2,266	$ 2,373	$ 2,485	$ 2,603
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 1,971**	**$ (4,505)**	**$ 2,163**	**$ 2,266**	**$ 2,373**	**$ 2,485**	**$ 2,603**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 1,971	$ (4,505)	$ 2,163	$ 2,266	$ 2,373	$ 2,485	$ 2,603
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 1,971	$ (4,505)	$ 2,163	$ 2,266	$ 2,373	$ 2,485	$ 2,603
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 1,971**	**$ (4,505)**	**$ 2,163**	**$ 2,266**	**$ 2,373**	**$ 2,485**	**$ 2,603**
Cumulative Cash Flow	**$ 1,476**	**$ (3,029)**	**$ (866)**	**$ 1,400**	**$ 3,773**	**$ 6,258**	**$ 8,861**

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Scenario B: Taxable Rebate; Pro Forma Project Economics					
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 3,177	$ 3,319	$ 3,468	$ 3,623	$ 3,785
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 3,177	$ 3,319	$ 3,468	$ 3,623	$ 3,785
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 2,726	$ 2,854	$ 2,989	$ 3,130	$ 3,277
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 2,726	$ 2,854	$ 2,989	$ 3,130	$ 3,277
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 2,726	$ 2,854	$ 2,989	$ 3,130	$ 3,277
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate					
Net Income	**$ 2,726**	**$ 2,854**	**$ 2,989**	**$ 3,130**	**$ 3,277**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 2,726	$ 2,854	$ 2,989	$ 3,130	$ 3,277
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 2,726	$ 2,854	$ 2,989	$ 3,130	$ 3,277
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 2,726**	**$ 2,854**	**$ 2,989**	**$ 3,130**	**$ 3,277**
Cumulative Cash Flow	**$ 11,586**	**$ 14,441**	**$ 17,430**	**$ 20,559**	**$ 23,836**

OFFICE BUILDING AT 1010 MASSACHUSETTS AVE

Table 43: 1010 Mass Ave PV Profile

Building	
Building Name	Office Building
Building Address	1010 Massachusetts Avenue
City Department	Boston Property Management and Construction
Number of floors	
Square footage (if known)	
Year built (if known)	
Fuel Type(s)	
Contact Information	
Facilities Manager	John Sinagra
Phone	(617) 635-4109
Email	John.Sinagra@CityOfBoston.gov
Electrical Connection	
Electric Utility Company	
Floor Plan showing Electrical room	Yes / No
Roof Details	
Roof slope/angle (Flat = 0^{o})	0^{o}
Roof Orientation (S, SE, SW, etc.)	N/A
Roof Size – Square Feet	32500 sq ft
Roof Condition: poor, fair, good, excellent, new	
Roof Type (asphalt, shingles, rubber membrane, etc.)	Rubber membrane
Expected life of roof (years)	
Equipment/obstructions on the roof	If Yes, please describe briefly
Detailed Roof Drawings available	Yes / No

Table 44: 1010 Mass Ave Summary of Findings

Summary of Findings	
Suited for Solar Water Heating?	No
Site Efficiency	91.69%
Area of roof available for panel installation	13000 sq ft
Maximum number of panels that can be installed	810
DC Output of maximum number of panels	27478 W
Net Capacity Factor (%)	11.3%
Cost of Installation:	

Figure 37: 1010 Mass Ave Solar Pathfinder Report

WPI Solar Team and Solar Boston Site Report

Report Name	1010 Mass Ave
Report Date	4/8/2008 1:59:08 PM
Declination	-15d 14m
Location	BOSTON, MA, Zipcode: 02114
Lat/Long	42.362 / -71.024
Weather Station	BOSTON, MA, Elevation: 5 m
Site distance	0.59 miles
Array Type	Fixed
Tilt Angle	42.36 deg
Ideal Tilt Angle	42.36 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Make	Evergreen Solar
Panel Model	ES-195-RL
Panel Count	810
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	Custom
Layout Point Count	6

Notes: [None]
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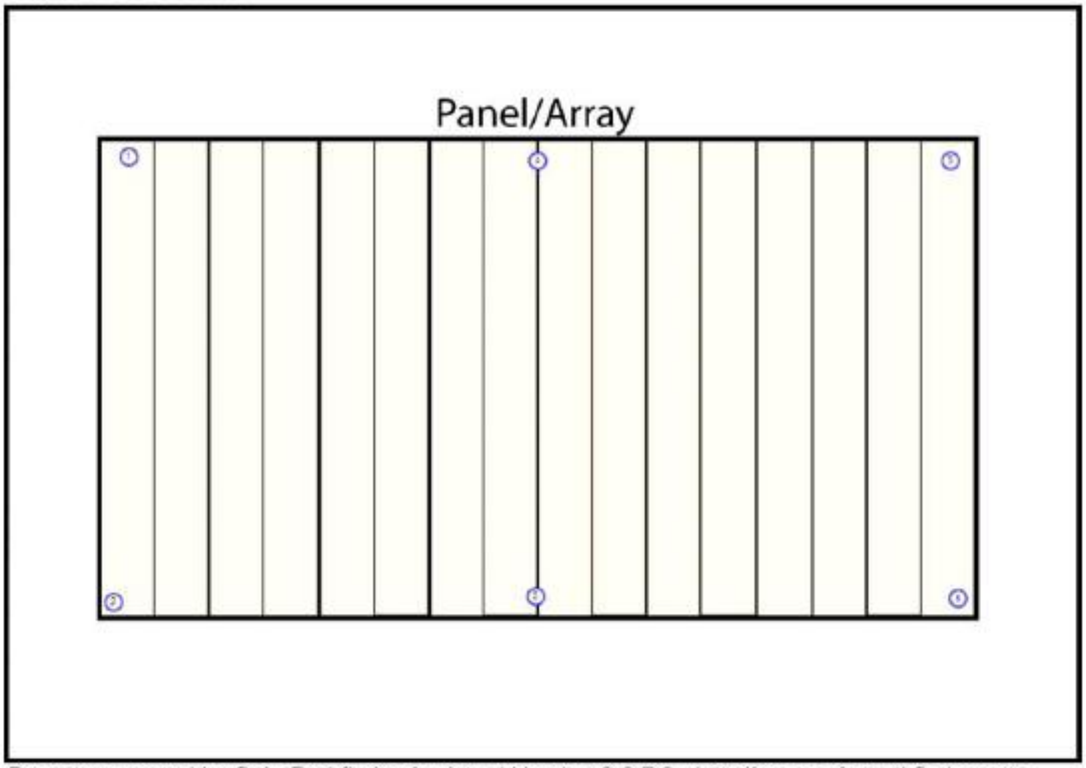
WPI Solar Team and Solar Boston
System Picture Layout

Layout Type Custom
Layout Point Count 6



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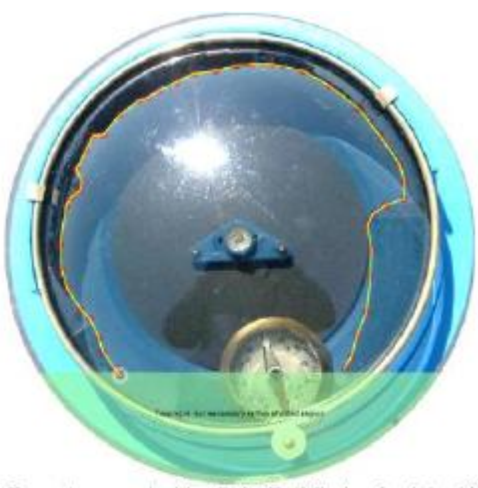
WPI Solar Team and Solar Boston
Solar Site Analysis Report

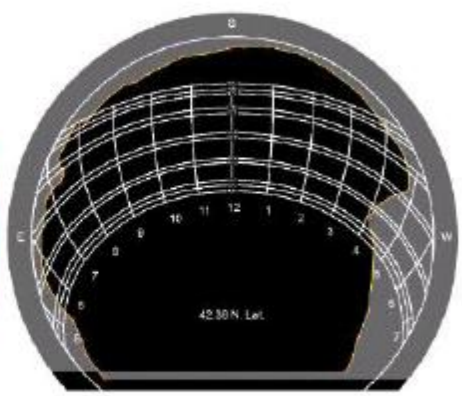
Image File AY2008_0408_112508.JPG

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	98.00%	3.28	13751.00	13612.82
February	98.00%	4.27	16100.00	15895.61
March	98.00%	4.69	18842.00	18665.02
April	96.00%	4.70	18329.00	17836.80
May	95.00%	5.08	19578.00	19098.86
June	96.00%	5.17	18555.00	18199.35
July	95.00%	5.35	19808.00	19329.00
August	95.00%	5.34	20096.00	19402.85
September	98.00%	5.01	18135.00	17910.40
October	96.00%	4.49	17599.00	17175.51
November	97.00%	3.06	11920.00	11709.40
December	94.00%	2.79	11911.00	11308.13
Totals	**96.26%**	**53.22**	**204624.0**	**200143.75**
	Unweighted Yearly Avg	**Effect: 96.21% Sun Hrs: 4.44**		

Notes: [None]





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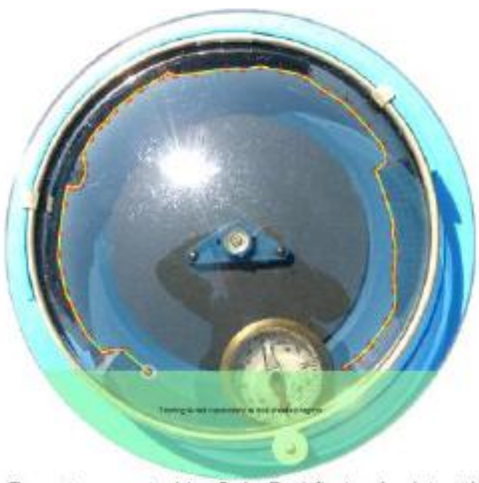
WPI Solar Team and Solar E 2 st
Solar Site Analysis Report

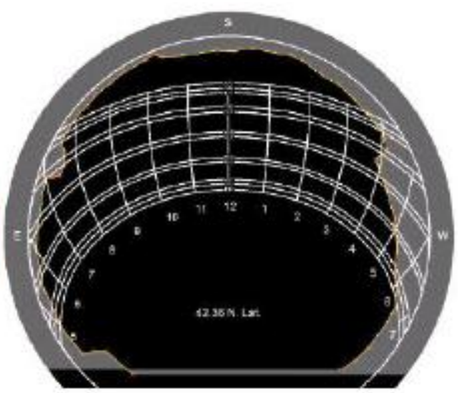
Image File AY2008_0408_112540.JPG

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	97.00%	3.24	13751.00	13473.37
February	96.00%	4.18	16100.00	15653.15
March	96.00%	4.62	18842.00	18440.06
April	98.00%	4.83	18329.00	18267.93
May	99.00%	5.27	19578.00	19563.10
June	99.00%	5.37	18555.00	18552.96
July	99.00%	5.55	19808.00	19795.68
August	98.00%	5.55	20096.00	20061.36
September	97.00%	4.98	18135.00	17837.30
October	95.00%	4.41	17599.00	17004.03
November	97.00%	3.05	11920.00	11693.34
December	96.00%	2.85	11911.00	11579.67
Totals	**97.26%**	**53.89**	**204624.0**	**201921.95**
	Unweighted Yearly Avg	**Effect: 97.43% Sun Hrs: 4.49**		

Notes: [None]





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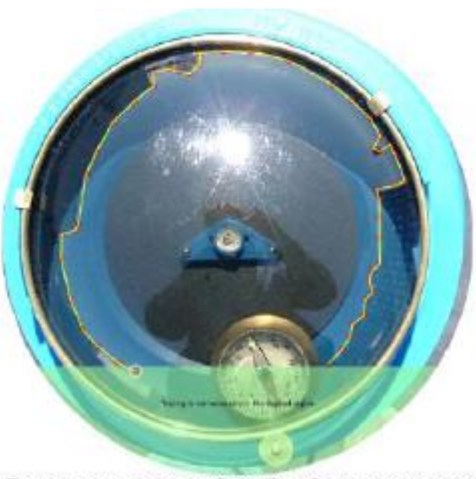
WPI Solar Team and Solar E 3 st
Solar Site Analysis Report

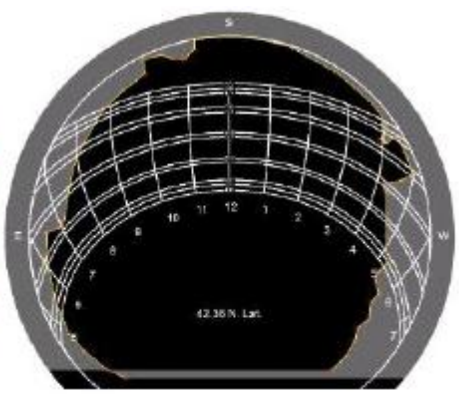
Image File AY2008_0408_112622.JPG

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	93.00%	3.11	13751.00	12940.82
February	96.00%	4.17	16100.00	15571.83
March	94.00%	4.48	18842.00	18017.75
April	97.00%	4.77	18329.00	18082.21
May	98.00%	5.22	19578.00	19538.41
June	98.00%	5.29	18555.00	18485.04
July	98.00%	5.48	19808.00	19726.24
August	97.00%	5.46	20096.00	19812.50
September	93.00%	4.75	18135.00	17140.81
October	93.00%	4.31	17599.00	16475.64
November	91.00%	2.85	11920.00	10956.33
December	90.00%	2.69	11911.00	10885.97
Totals	**94.60%**	**52.57**	**204624.0**	**197633.56**
	Unweighted Yearly Avg	**Effect: 95.04% Sun Hrs: 4.38**		

Notes: [None]





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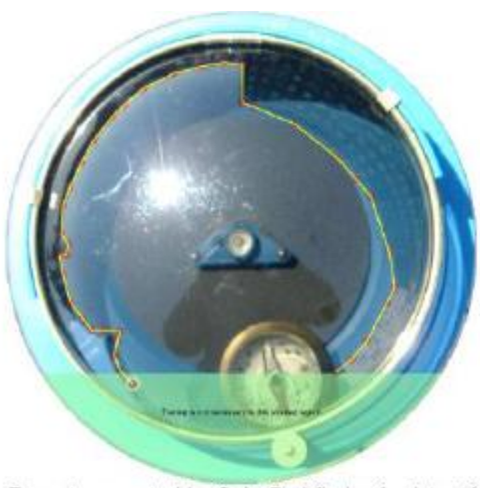
WPI Solar Team and Solar Boston
Solar Site Analysis Report

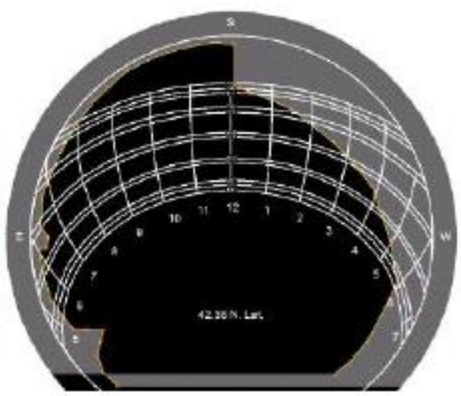
Image File AY2008_0408_112656.JPG

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m²/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	57.00%	1.91	13751.00	7977.85
February	74.00%	3.24	16100.00	12090.25
March	90.00%	4.30	18842.00	17175.45
April	96.00%	4.73	18329.00	17930.59
May	98.00%	5.25	19578.00	19553.17
June	99.00%	5.34	18555.00	18544.23
July	99.00%	5.53	19808.00	19773.71
August	96.00%	5.43	20096.00	19681.32
September	92.00%	4.72	18135.00	16952.00
October	82.00%	3.81	17599.00	14706.49
November	66.00%	2.07	11920.00	8019.41
December	55.00%	1.64	11911.00	6721.99
Totals	**83.65%**	**47.95**	**204624.0**	**179126.49**
	Unweighted	**Effect: 86.69%**		
	Yearly Avg	**Sun Hrs: 4.00**		

Notes: [None]





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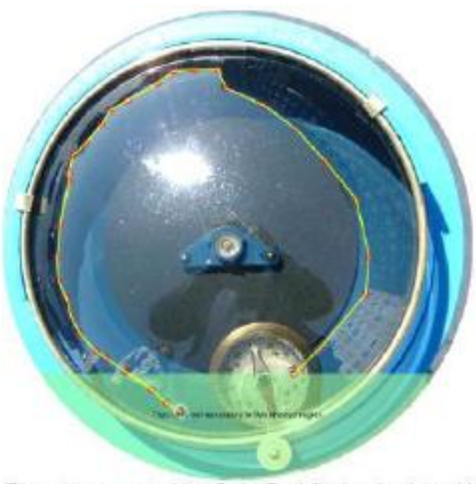
WPI Solar Team and Solar Boston
Solar Site Analysis Report

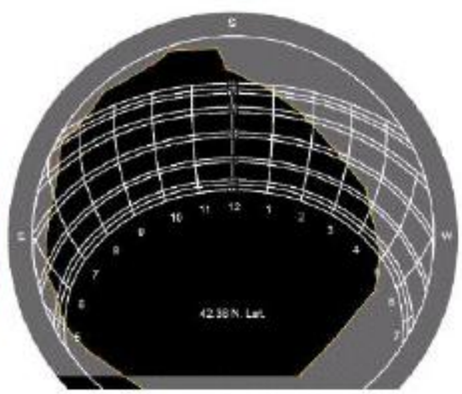
Image File AY2008_0408_112738.JPG

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	67.00%	2.26	13751.00	9444.82
February	75.00%	3.29	16100.00	12292.25
March	86.00%	4.11	18842.00	16488.02
April	94.00%	4.62	18329.00	17558.15
May	96.00%	5.12	19578.00	19238.92
June	97.00%	5.24	18555.00	18383.65
July	97.00%	5.41	19808.00	19509.33
August	94.00%	5.30	20096.00	19255.73
September	89.00%	4.55	18135.00	16408.81
October	81.00%	3.78	17599.00	14628.05
November	74.00%	2.33	11920.00	9021.71
December	64.00%	1.92	11911.00	7838.78
Totals	**84.57%**	**47.95**	**204624.0**	**180068.22**
	Unweighted Yearly Avg	**Effect: 86.68% Sun Hrs: 4.00**		

Notes: [None]





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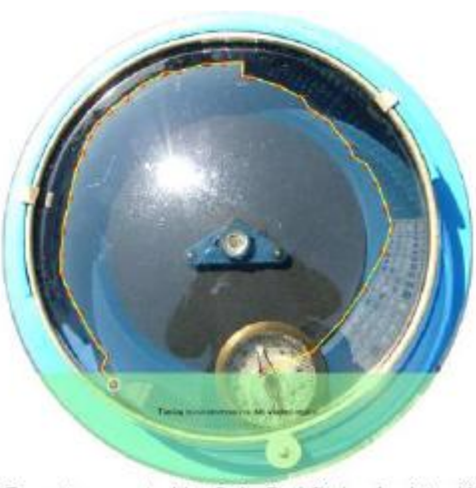
WPI Solar Team and Solar E6st
Solar Site Analysis Report

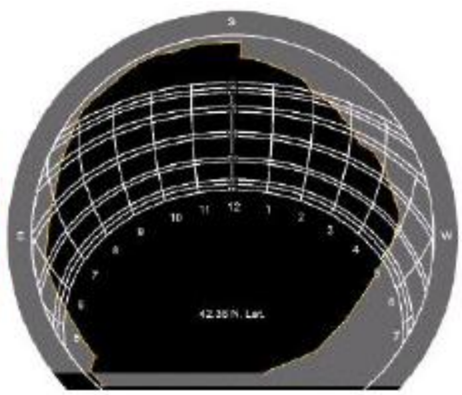
Image File AY2008_0408_112814.JPG

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	85.00%	2.87	13751.00	11978.50
February	90.00%	3.91	16100.00	14662.23
March	96.00%	4.60	18842.00	18449.13
April	98.00%	4.82	18329.00	18259.09
May	98.00%	5.22	19578.00	19538.03
June	97.00%	5.26	18555.00	18464.10
July	97.00%	5.46	19808.00	19698.99
August	98.00%	5.53	20096.00	20025.28
September	97.00%	4.95	18135.00	17785.73
October	92.00%	4.26	17599.00	16479.46
November	90.00%	2.81	11920.00	10910.98
December	85.00%	2.52	11911.00	10287.90
Totals	**93.50%**	**52.21**	**204624.0**	**196539.42**
	Unweighted	**Effect: 94.39%**		
	Yearly Avg	**Sun Hrs: 4.35**		

Notes: [None]





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WPI Solar Team and Solar Bost
Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 $KWH/m^2/day$	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	82.83%	2.78	13751.00	11571.36
February	88.17%	3.84	16100.00	14360.89
March	93.33%	4.47	18842.00	17872.57
April	96.50%	4.75	18329.00	17989.13
May	97.33%	5.19	19578.00	19421.75
June	97.67%	5.28	18555.00	18438.22
July	97.50%	5.46	19808.00	19638.83
August	96.33%	5.44	20096.00	19706.51
September	94.33%	4.83	18135.00	17339.18
October	89.83%	4.18	17599.00	16078.20
November	85.83%	2.70	11920.00	10385.20
December	80.67%	2.40	11911.00	9770.41
Totals	**91.69%**	**53.22**	**204624.0**	**192572.23**
	Unweighted	**Effect: 92.74%**		
	Yearly Avg	**Sun Hrs: 4.28**		

Notes: [None]

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Table 45: 1010 Mass Ave MTC Rebate Estimator Summary

Commonwealth Solar Non-Residential Solar Photovoltaic Calculator

Non-Residential: Commonwealth Solar Rebate Matrix ($/watt dc)				
Incremental Capacity	**1 to 25 kW** (1,000 to 25,000 watts)	**> 25 to 100 kW**	**> 100 kW to 200 kW**	**> 200 kW to 500 kW**
Base Incentive ($/watt dc)	$3.25	$2.50	$2.00	$1.50
PLUS: Additions to Base				
MA-Manufactured Components	$0.25	$0.25	$0.25	$0.25
Public Building Adder	$0.50	$0.50	$0.25	$0.25

Non-Residential: Commonwealth Solar Rebate Calculator	
Total PV Project Size (watts dc)	**27,478**
Total PV Project Size for Rebate Calculation (500 kW cap)	**27,478**
MA-manufactured components	YES
Public Building Adder	YES
Rebate ($)	**$ 108,053.50**
Rebate ($/watt dc) based on total project size	**$ 3.93236**

Click here for Financial Model

Key

Entry Cells	
Calculation Cells (not for Entry)	

DATA ENTRY AND FINANCIAL SUMMARY

Key		
Entry Cells		
Cells Draw Data from Another Worksheet		
Calculation Cells (Not for Entry)		
Select Taxable or Non-Taxable Entity	Non-Taxable	
Project and Customer Cost Assumptions		
Solar Photovoltaic System Size	27,478	Watts (DC STC)
Total System Cost/Watt	$ 7.00	$/Watt (DC STC)
Total System Cost	$ 192,346	
MTC Rebate Assumptions		
MTC Scenario A: Non-Taxable Rebate	$ 3.932	$/Watt (DC STC)
Scenario A Rebate	$ 108,054	
MTC Scenario B: Taxable Rebate	$ 4.439	$/Watt (DC STC)
Scenario B Rebate	$ 121,975	
Project Performance and Savings/ Cost Assumptions		
Annual Net Capacity Factor	11.3%	kW (DC STC) to kWh AC
Annual Production Degradation	0.50%	%
Project Life	25	Years
Electricity Revenue (Avoided Costs)	$ 0.15	$/kWh
Electricity Revenue (Avoided Costs) Annual Adjustor	5.0%	%
Renewable Energy Certificate (REC) Revenue	$ 0.03	$/kWh
REC Revenue Annual Adjustor	0.0%	%
REC Revenue Term	3	Years (must be equal to or less thai
Annual Operations and Maintenance Cost	$ 250	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.75	$/Watt (DC STC)
Inverter Life, Replace Every X Years	15	Year (must be equal to or less than

Scenario Definitions

Scenario A: Non-Taxable Rebate - Assumes that the state rebate is non-taxable, but is subtracted from the cost basis for purposes of determini

Scenario B: Taxable Rebate - Assumes that the state rebate is taxable, but is not subtracted from the cost basis for purposes of determining ta

Both Scenarios assume that the project owner can use both federal and state tax benefits

Tax Assumptions

Federal Tax Rate	0%					
State Tax Rate	0%					
Effective Tax Rate	0%					
Federal Tax Credit	0%					
State Tax Deduction	0%					
5 Year Accelerated Depreciation Schedule (MACRS)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Financing Assumptions

% Financed w/ Cash	100%	
% Financed w/ Loan	0%	
Loan Interest Rate	8%	
Loan Period	20	Years (must be equal to or less than project life)
Scenario A Net Cost	$ 84,293	
Scenario A Loan	$ -	
Scenario B Net Cost	$ 70,371	
Scenario B Loan	$ -	
Customer Discount Rate	6%	

Solar Project Financial Analysis Summary

Scenario A: Net Present Value	**$ (13,901)**
Scenario A: Simple Payback (100% Cash only)	**Year 18**
Scenario A: Estimated Return on Equity	**#DIV/0!**
Scenario A: Guess Return on Equity	50%
Scenario B: Net Present Value	**$ 20**
Scenario B: Simple Payback (100% Cash only)	**Year 14**
Scenario B: Estimated Return on Equity	**#DIV/0!**
Scenario B: Guess Return on Equity	50%

PRO FORMA AND PRODUCTION

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Annual Generation (kWh)		27,128	26,992	26,857	26,723	26,589	26,456

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 4,069	$ 4,251	$ 4,441	$ 4,640	$ 4,848	$ 5,065
REC Revenue		$ 814	$ 810	$ 806	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 4,883	$ 5,061	$ 5,247	$ 4,640	$ 4,848	$ 5,065
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 4,633	$ 4,804	$ 4,982	$ 4,367	$ 4,567	$ 4,775
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 4,633	$ 4,804	$ 4,982	$ 4,367	$ 4,567	$ 4,775
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 4,633	$ 4,804	$ 4,982	$ 4,367	$ 4,567	$ 4,775
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Net Income		**$ 4,633**	**$ 4,804**	**$ 4,982**	**$ 4,367**	**$ 4,567**	**$ 4,775**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 4,633	$ 4,804	$ 4,982	$ 4,367	$ 4,567	$ 4,775
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 4,633	$ 4,804	$ 4,982	$ 4,367	$ 4,567	$ 4,775
Cash From Investing							
Installed PV Cost	$ (84,293)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (84,293)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ (84,293)**	**$ 4,633**	**$ 4,804**	**$ 4,982**	**$ 4,367**	**$ 4,567**	**$ 4,775**
Cumulative Cash Flow	**$ (84,293)**	**$ (79,660)**	**$ (74,856)**	**$ (69,874)**	**$ (65,507)**	**$ (60,940)**	**$ (56,165)**

PRO FORMA AND PRODUCTION

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Annual Generation (kWh)	26,324	26,192	26,061	25,931	25,801	25,672	25,544

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 5,291	$ 5,528	$ 5,776	$ 6,034	$ 6,304	$ 6,586	$ 6,881
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 5,291	$ 5,528	$ 5,776	$ 6,034	$ 6,304	$ 6,586	$ 6,881
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 4,993	$ 5,221	$ 5,459	$ 5,708	$ 5,968	$ 6,240	$ 6,525
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 4,993	$ 5,221	$ 5,459	$ 5,708	$ 5,968	$ 6,240	$ 6,525
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 4,993	$ 5,221	$ 5,459	$ 5,708	$ 5,968	$ 6,240	$ 6,525
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 4,993**	**$ 5,221**	**$ 5,459**	**$ 5,708**	**$ 5,968**	**$ 6,240**	**$ 6,525**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 4,993	$ 5,221	$ 5,459	$ 5,708	$ 5,968	$ 6,240	$ 6,525
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 4,993	$ 5,221	$ 5,459	$ 5,708	$ 5,968	$ 6,240	$ 6,525
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 4,993**	**$ 5,221**	**$ 5,459**	**$ 5,708**	**$ 5,968**	**$ 6,240**	**$ 6,525**
Cumulative Cash Flow	**$ (51,172)**	**$ (45,952)**	**$ (40,493)**	**$ (34,785)**	**$ (28,816)**	**$ (22,576)**	**$ (16,052)**

PRO FORMA AND PRODUCTION

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Annual Generation (kWh)	25,416	25,289	25,163	$ 25,037	24,912	24,787	24,663

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 7,189	$ 7,511	$ 7,847	$ 8,198	$ 8,565	$ 8,948	$ 9,348
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 7,189	$ 7,511	$ 7,847	$ 8,198	$ 8,565	$ 8,948	$ 9,348
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (20,609)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (20,987)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 6,822	$ (13,476)	$ 7,457	$ 7,797	$ 8,152	$ 8,522	$ 8,910
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 6,822	$ (13,476)	$ 7,457	$ 7,797	$ 8,152	$ 8,522	$ 8,910
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 6,822	$ (13,476)	$ 7,457	$ 7,797	$ 8,152	$ 8,522	$ 8,910
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 6,822**	**$ (13,476)**	**$ 7,457**	**$ 7,797**	**$ 8,152**	**$ 8,522**	**$ 8,910**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 6,822	$ (13,476)	$ 7,457	$ 7,797	$ 8,152	$ 8,522	$ 8,910
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 6,822	$ (13,476)	$ 7,457	$ 7,797	$ 8,152	$ 8,522	$ 8,910
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 6,822**	**$ (13,476)**	**$ 7,457**	**$ 7,797**	**$ 8,152**	**$ 8,522**	**$ 8,910**
Cumulative Cash Flow	**$ (9,230)**	**$ (22,706)**	**$ (15,249)**	**$ (7,452)**	**$ 700**	**$ 9,222**	**$ 18,132**

PRO FORMA AND PRODUCTION

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Annual Generation (kWh)	24,540	24,417	24,295	24,174	24,053

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 21	Year 22	Year 23	Year 24	Year 25
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 9,767	$ 10,204	$ 10,660	$ 11,138	$ 11,636
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 9,767	$ 10,204	$ 10,660	$ 11,138	$ 11,636
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 9,315	$ 9,739	$ 10,181	$ 10,644	$ 11,128
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 9,315	$ 9,739	$ 10,181	$ 10,644	$ 11,128
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 9,315	$ 9,739	$ 10,181	$ 10,644	$ 11,128
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 9,315**	**$ 9,739**	**$ 10,181**	**$ 10,644**	**$ 11,128**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 9,315	$ 9,739	$ 10,181	$ 10,644	$ 11,128
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 9,315	$ 9,739	$ 10,181	$ 10,644	$ 11,128
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 9,315**	**$ 9,739**	**$ 10,181**	**$ 10,644**	**$ 11,128**
Cumulative Cash Flow	**$ 27,447**	**$ 37,186**	**$ 47,368**	**$ 58,012**	**$ 69,140**

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 4,069	$ 4,251	$ 4,441	$ 4,640	$ 4,848	$ 5,065
REC Revenue		$ 814	$ 810	$ 806	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 4,883	$ 5,061	$ 5,247	$ 4,640	$ 4,848	$ 5,065
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 4,633	$ 4,804	$ 4,982	$ 4,367	$ 4,567	$ 4,775
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 4,633	$ 4,804	$ 4,982	$ 4,367	$ 4,567	$ 4,775
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 4,633	$ 4,804	$ 4,982	$ 4,367	$ 4,567	$ 4,775
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate		$ -					
Net Income		**$ 4,633**	**$ 4,804**	**$ 4,982**	**$ 4,367**	**$ 4,567**	**$ 4,775**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 4,633	$ 4,804	$ 4,982	$ 4,367	$ 4,567	$ 4,775
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 4,633	$ 4,804	$ 4,982	$ 4,367	$ 4,567	$ 4,775
Cash From Investing							
Installed PV Cost	$ (70,371)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (70,371)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ (70,371)**	**$ 4,633**	**$ 4,804**	**$ 4,982**	**$ 4,367**	**$ 4,567**	**$ 4,775**
Cumulative Cash Flow	**$ (70,371)**	**$ (65,738)**	**$ (60,935)**	**$ (55,953)**	**$ (51,586)**	**$ (47,019)**	**$ (42,244)**

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 5,291	$ 5,528	$ 5,776	$ 6,034	$ 6,304	$ 6,586	$ 6,881
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 5,291	$ 5,528	$ 5,776	$ 6,034	$ 6,304	$ 6,586	$ 6,881
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 4,993	$ 5,221	$ 5,459	$ 5,708	$ 5,968	$ 6,240	$ 6,525
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 4,993	$ 5,221	$ 5,459	$ 5,708	$ 5,968	$ 6,240	$ 6,525
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 4,993	$ 5,221	$ 5,459	$ 5,708	$ 5,968	$ 6,240	$ 6,525
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 4,993**	**$ 5,221**	**$ 5,459**	**$ 5,708**	**$ 5,968**	**$ 6,240**	**$ 6,525**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 4,993	$ 5,221	$ 5,459	$ 5,708	$ 5,968	$ 6,240	$ 6,525
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 4,993	$ 5,221	$ 5,459	$ 5,708	$ 5,968	$ 6,240	$ 6,525
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 4,993**	**$ 5,221**	**$ 5,459**	**$ 5,708**	**$ 5,968**	**$ 6,240**	**$ 6,525**
Cumulative Cash Flow	**$ (37,251)**	**$ (32,030)**	**$ (26,571)**	**$ (20,863)**	**$ (14,895)**	**$ (8,655)**	**$ (2,130)**

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 7,189	$ 7,511	$ 7,847	$ 8,198	$ 8,565	$ 8,948	$ 9,348
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 7,189	$ 7,511	$ 7,847	$ 8,198	$ 8,565	$ 8,948	$ 9,348
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (20,609)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (20,987)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 6,822	$ (13,476)	$ 7,457	$ 7,797	$ 8,152	$ 8,522	$ 8,910
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 6,822	$ (13,476)	$ 7,457	$ 7,797	$ 8,152	$ 8,522	$ 8,910
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 6,822	$ (13,476)	$ 7,457	$ 7,797	$ 8,152	$ 8,522	$ 8,910
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 6,822**	**$ (13,476)**	**$ 7,457**	**$ 7,797**	**$ 8,152**	**$ 8,522**	**$ 8,910**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 6,822	$ (13,476)	$ 7,457	$ 7,797	$ 8,152	$ 8,522	$ 8,910
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 6,822	$ (13,476)	$ 7,457	$ 7,797	$ 8,152	$ 8,522	$ 8,910
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 6,822**	**$ (13,476)**	**$ 7,457**	**$ 7,797**	**$ 8,152**	**$ 8,522**	**$ 8,910**
Cumulative Cash Flow	**$ 4,692**	**$ (8,784)**	**$ (1,327)**	**$ 6,470**	**$ 14,621**	**$ 23,143**	**$ 32,054**

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Scenario B: Taxable Rebate; Pro Forma Project Economics					
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 9,767	$ 10,204	$ 10,660	$ 11,138	$ 11,636
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 9,767	$ 10,204	$ 10,660	$ 11,138	$ 11,636
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 9,315	$ 9,739	$ 10,181	$ 10,644	$ 11,128
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 9,315	$ 9,739	$ 10,181	$ 10,644	$ 11,128
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 9,315	$ 9,739	$ 10,181	$ 10,644	$ 11,128
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate					
Net Income	**$ 9,315**	**$ 9,739**	**$ 10,181**	**$ 10,644**	**$ 11,128**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 9,315	$ 9,739	$ 10,181	$ 10,644	$ 11,128
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 9,315	$ 9,739	$ 10,181	$ 10,644	$ 11,128
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 9,315**	**$ 9,739**	**$ 10,181**	**$ 10,644**	**$ 11,128**
Cumulative Cash Flow	**$ 41,369**	**$ 51,108**	**$ 61,289**	**$ 71,933**	**$ 83,061**

STRAND THEATER

Table 46: Strand Theater PV Profile

Building	
Building Name	Strand Theater
Building Address	543 Columbia Road Dorchester, MA 02131
City Department	Other
Number of floors	
Square footage (if known)	
Fuel Type(s)	
Contact Information	
Facilities Manager	Melodi Greene
Phone	617-282-8000
Email	Melodi.Greene@CityOfBoston.gov
Electrical Connection	
Electric Utility Company	
Floor Plan showing Electrical room	Yes / No
Roof Details	
Roof slope/angle (Flat = 0°)	
Roof Orientation (S, SE, SW, etc.)	
Roof Size – Square Feet	16085.7 sq ft
Digital Photos of Roof Available?	Yes / No
Roof Condition: poor, fair, good, excellent, new	Good
Roof Type (asphalt, shingles, rubber membrane, etc.)	Rubber membrane
Expected life of roof (years)	
Equipment/obstructions on the roof	If Yes, please describe briefly
Detailed Roof Drawings available	Yes / No

Table 47: Strand Theater Summary of Findings

Summary of Findings	
Suited for Solar Water Heating?	No
Site Efficiency	98.73%
Area of roof available for panel installation	6434.28 sq ft
Maximum number of panels that can be installed	401
DC Output of maximum number of panels	14364 W
Net Capacity Factor (%)	14.7%
Cost of Installation:	

Figure 38: Strand Theater Solar Pathfinder Report

WPI Solar Team and Solar Boston Site Report

Report Name	Strand Theater
Report Date	4/8/2008 1:36:20 PM
Declination	-15d 14m
Location	BOSTON, MA, Zipcode: 02114
Lat/Long	42.362 / -71.024
Weather Station	BOSTON, MA, Elevation: 5 m
Site distance	0.59 miles
Array Type	Fixed
Tilt Angle	42.36 deg
Ideal Tilt Angle	42.36 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Make	Evergreen Solar
Panel Model	ES-195-RL
Panel Count	401
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	FourCorner
Layout Point Count	4

Notes: April 8, 2008 10 AM

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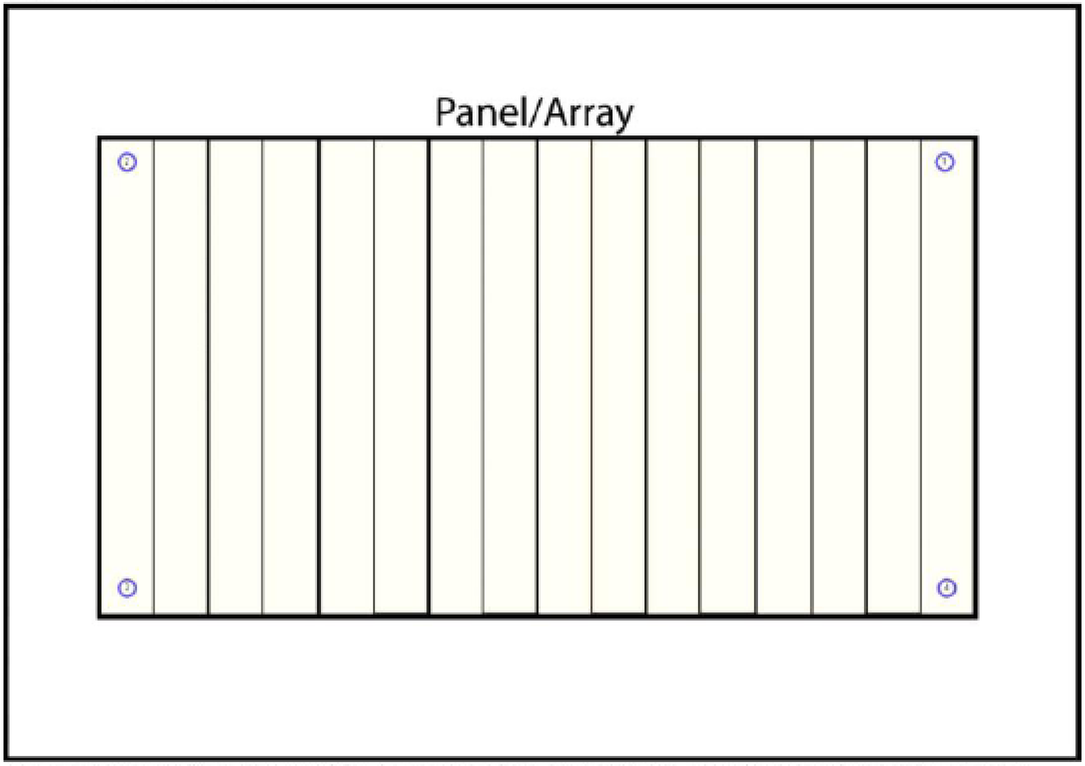
WPI Solar Team and Solar Boston
System Picture Layout

Layout Type Four Corners
Layout Point Count 4



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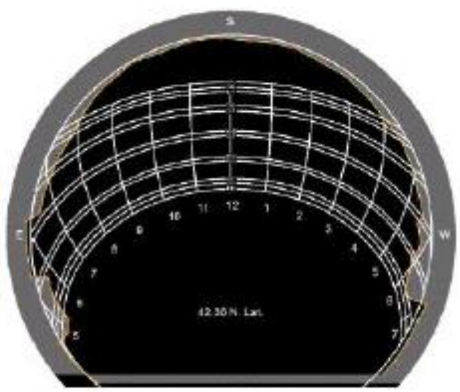
WPI Solar Team and Solar E1st Solar Site Analysis Report

Image File AY2008_0408_101422.JPG

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	98.00%	3.28	6807.00	6734.00
February	99.00%	4.31	7972.00	7917.39
March	100.00%	4.79	9328.00	9328.00
April	100.00%	4.89	9075.00	9074.50
May	99.00%	5.30	9693.00	9691.10
June	100.00%	5.39	9185.00	9182.38
July	100.00%	5.58	9807.00	9805.84
August	99.00%	5.60	9948.00	9945.73
September	100.00%	5.12	8979.00	8979.00
October	98.00%	4.57	8712.00	8640.44
November	97.00%	3.03	5902.00	5754.03
December	96.00%	2.87	5896.00	5735.09
Totals	**98.74%**	**54.74**	**101304.0**	**100787.49**
	Unweighted Yearly Avg	**Effect: 98.96% Sun Hrs: 4.56**		

Notes: [None]



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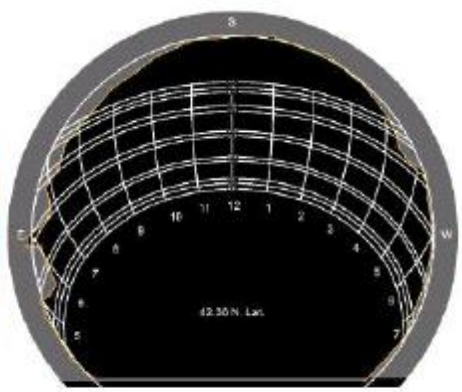
WPI Solar Team and Solar E 2 st
Solar Site Analysis Report

Image File AY2008_0408_101512.JPG

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	98.00%	3.27	6807.00	6711.78
February	99.00%	4.31	7972.00	7909.54
March	99.00%	4.75	9328.00	9313.41
April	100.00%	4.90	9075.00	9075.00
May	100.00%	5.33	9693.00	9693.00
June	100.00%	5.41	9185.00	9185.00
July	100.00%	5.60	9807.00	9807.00
August	100.00%	5.62	9948.00	9948.00
September	100.00%	5.12	8979.00	8979.00
October	98.00%	4.55	8712.00	8602.88
November	97.00%	3.04	5902.00	5765.03
December	95.00%	2.83	5896.00	5667.18
Totals	**98.67%**	**54.73**	**101304.0**	**100656.83**
	Unweighted Yearly Avg	**Effect: 98.95% Sun Hrs: 4.56**		

Notes: [None]



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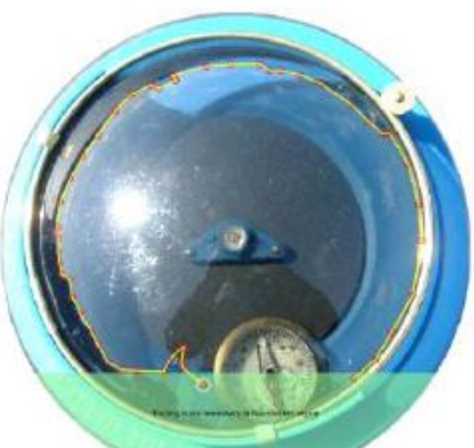
WPI Solar Team and Solar E3st
Solar Site Analysis Report

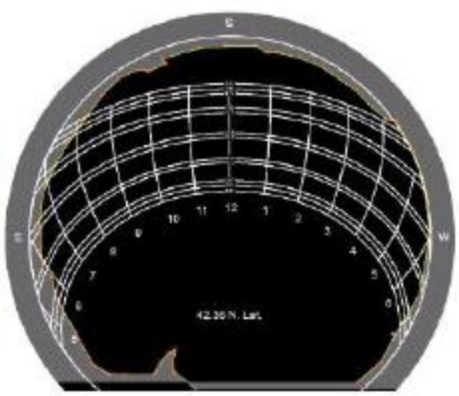
Image File AY2008_0408_101558.JPG

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	98.00%	3.27	6807.00	6695.56
February	99.00%	4.32	7972.00	7923.42
March	100.00%	4.77	9328.00	9320.28
April	100.00%	4.90	9075.00	9075.00
May	99.00%	5.29	9693.00	9690.32
June	99.00%	5.37	9185.00	9181.07
July	99.00%	5.57	9807.00	9805.40
August	100.00%	5.62	9948.00	9948.00
September	99.00%	5.08	8979.00	8943.99
October	98.00%	4.57	8712.00	8640.44
November	96.00%	3.02	5902.00	5732.01
December	95.00%	2.84	5896.00	5667.18
Totals	**98.49%**	**54.62**	**101304.0**	**100622.67**
	Unweighted Yearly Avg	**Effect: 98.74% Sun Hrs: 4.55**		

Notes: [None]





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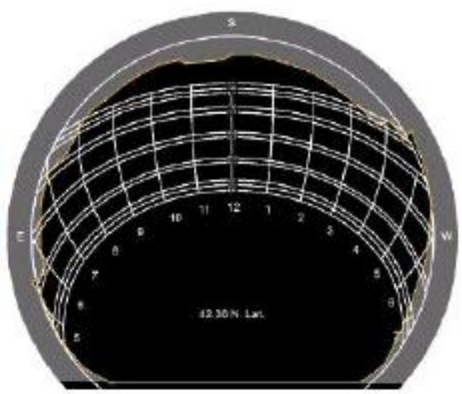
WPI Solar Team and Solar E4st
Solar Site Analysis Report

Image File AY2008_0408_101650.JPG

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	97.00%	3.24	6807.00	6639.73
February	100.00%	4.35	7972.00	7965.06
March	100.00%	4.77	9328.00	9322.18
April	100.00%	4.91	9075.00	9075.00
May	100.00%	5.32	9693.00	9693.00
June	100.00%	5.40	9185.00	9185.00
July	100.00%	5.59	9807.00	9806.85
August	100.00%	5.63	9948.00	9948.00
September	99.00%	5.09	8979.00	8955.66
October	99.00%	4.59	8712.00	8680.54
November	96.00%	3.02	5902.00	5732.01
December	94.00%	2.79	5896.00	5607.93
Totals	**98.57%**	**54.71**	**101304.0**	**100610.95**
	Unweighted Yearly Avg	**Effect: 98.91% Sun Hrs: 4.56**		

Notes: [None]



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WPI Solar Team and Solar Bost Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	97.75%	3.27	6807.00	6695.27
February	99.25%	4.32	7972.00	7928.85
March	99.75%	4.77	9328.00	9320.97
April	100.00%	4.90	9075.00	9074.88
May	99.50%	5.31	9693.00	9691.86
June	99.75%	5.39	9185.00	9183.36
July	99.75%	5.59	9807.00	9806.27
August	99.75%	5.62	9948.00	9947.43
September	99.50%	5.10	8979.00	8964.41
October	98.25%	4.57	8712.00	8641.08
November	96.50%	3.03	5902.00	5745.77
December	95.00%	2.83	5896.00	5669.35
Totals	**98.73%**	**54.74**	**101304.0**	**100669.49**
	Unweighted	**Effect: 98.89%**		
	Yearly Avg	**Sun Hrs: 4.56**		

Notes: April 8, 2008 10 AM
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Table 48: Strand Theater MTC Rebate Estimator Summary

Commonwealth Solar Non-Residential Solar Photovoltaic Calculator

Non-Residential: Commonwealth Solar Rebate Matrix ($/watt dc)				
Incremental Capacity	**1 to 25 kW** (1,000 to 25,000 watts)	**> 25 to 100 kW**	**> 100 kW to 200 kW**	**> 200 kW to 500 kW**
Base Incentive ($/watt dc)	$3.25	$2.50	$2.00	$1.50
PLUS: Additions to Base				
MA-Manufactured Components	$0.25	$0.25	$0.25	$0.25
Public Building Adder	$0.50	$0.50	$0.25	$0.25

Non-Residential: Commonwealth Solar Rebate Calculator	
Total PV Project Size (watts dc)	**14,364**
Total PV Project Size for Rebate Calculation (500 kW cap)	**14,364**
MA-manufactured components	YES
Public Building Adder	YES
Rebate ($)	**$ 57,456.00**
Rebate ($/watt dc) based on total project size	**$ 4.00000**
Key	
Entry Cells	
Calculation Cells (not for Entry)	

Click here for Financial Model

DATA ENTRY AND FINANCIAL SUMMARY

Key

Entry Cells	
Cells Draw Data from Another Worksheet	
Calculation Cells (Not for Entry)	

Select Taxable or Non-Taxable Entity	Non-Taxable	
Project and Customer Cost Assumptions		
Solar Photovoltaic System Size	14,364	Watts (DC STC)
Total System Cost/Watt	$ 7.00	$/Watt (DC STC)
Total System Cost	$ 100,548	
MTC Rebate Assumptions		
MTC Scenario A: Non-Taxable Rebate	$ 4.000	$/Watt (DC STC)
Scenario A Rebate	$ 57,456	
MTC Scenario B: Taxable Rebate	$ 3.661	$/Watt (DC STC)
Scenario B Rebate	$ 52,587	
Project Performance and Savings/ Cost Assumptions		
Annual Net Capacity Factor	14.7%	kW (DC STC) to kWh AC
Annual Production Degradation	0.50%	%
Project Life	25	Years
Electricity Revenue (Avoided Costs)	$ 0.15	$/kWh
Electricity Revenue (Avoided Costs) Annual Adjustor	5.0%	%
Renewable Energy Certificate (REC) Revenue	$ 0.03	$/kWh
REC Revenue Annual Adjustor	0.0%	%
REC Revenue Term	3	Years (must be equal to or less thai
Annual Operations and Maintenance Cost	$ 250	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.75	$/Watt (DC STC)
Inverter Life, Replace Every X Years	15	Year (must be equal to or less than

Scenario Definitions

Scenario A: Non-Taxable Rebate - Assumes that the state rebate is non-taxable, but is subtracted from the cost basis for purposes of de

Scenario B: Taxable Rebate - Assumes that the state rebate is taxable, but is not subtracted from the cost basis for purposes of determi

Both Scenarios assume that the project owner can use both federal and state tax benefits

Tax Assumptions

Federal Tax Rate	0%					
State Tax Rate	0%					
Effective Tax Rate	0%					
Federal Tax Credit	0%					
State Tax Deduction	0%					
5 Year Accelerated Depreciation Schedule (MACRS)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Financing Assumptions

% Financed w/ Cash	100%	
% Financed w/ Loan	0%	
Loan Interest Rate	8%	
Loan Period	20	Years (must be equal to or less than project life)
Scenario A Net Cost	$ 43,092	
Scenario A Loan	$ -	
Scenario B Net Cost	$ 47,961	
Scenario B Loan	$ -	
Customer Discount Rate	6%	

Solar Project Financial Analysis Summary	
Scenario A: Net Present Value	**$ 4,875**
Scenario A: Simple Payback (100% Cash only)	**Year 13**
Scenario A: Estimated Return on Equity	**#DIV/0!**
Scenario A: Guess Return on Equity	50%
Scenario B: Net Present Value	**$ 6**
Scenario B: Simple Payback (100% Cash only)	**Year 14**
Scenario B: Estimated Return on Equity	**#DIV/0!**
Scenario B: Guess Return on Equity	50%

PRO FORMA AND PRODUCTION

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Annual Generation (kWh)		18,484	18,392	18,300	18,208	18,117	18,027

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 2,773	$ 2,897	$ 3,026	$ 3,162	$ 3,303	$ 3,451
REC Revenue		$ 555	$ 552	$ 549	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 3,327	$ 3,448	$ 3,575	$ 3,162	$ 3,303	$ 3,451
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 3,077	$ 3,191	$ 3,310	$ 2,889	$ 3,022	$ 3,161
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 3,077	$ 3,191	$ 3,310	$ 2,889	$ 3,022	$ 3,161
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 3,077	$ 3,191	$ 3,310	$ 2,889	$ 3,022	$ 3,161
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Net Income		**$ 3,077**	**$ 3,191**	**$ 3,310**	**$ 2,889**	**$ 3,022**	**$ 3,161**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 3,077	$ 3,191	$ 3,310	$ 2,889	$ 3,022	$ 3,161
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 3,077	$ 3,191	$ 3,310	$ 2,889	$ 3,022	$ 3,161
Cash From Investing							
Installed PV Cost	$ (43,092)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (43,092)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ (43,092)**	**$ 3,077**	**$ 3,191**	**$ 3,310**	**$ 2,889**	**$ 3,022**	**$ 3,161**
Cumulative Cash Flow	**$ (43,092)**	**$ (40,015)**	**$ (36,824)**	**$ (33,514)**	**$ (30,625)**	**$ (27,603)**	**$ (24,442)**

PRO FORMA AND PRODUCTION

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Annual Generation (kWh)	17,937	17,847	17,758	17,669	17,581	17,493	17,405

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 3,606	$ 3,767	$ 3,935	$ 4,112	$ 4,296	$ 4,488	$ 4,689
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 3,606	$ 3,767	$ 3,935	$ 4,112	$ 4,296	$ 4,488	$ 4,689
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 3,307	$ 3,459	$ 3,619	$ 3,785	$ 3,960	$ 4,142	$ 4,332
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 3,307	$ 3,459	$ 3,619	$ 3,785	$ 3,960	$ 4,142	$ 4,332
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 3,307	$ 3,459	$ 3,619	$ 3,785	$ 3,960	$ 4,142	$ 4,332
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 3,307**	**$ 3,459**	**$ 3,619**	**$ 3,785**	**$ 3,960**	**$ 4,142**	**$ 4,332**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 3,307	$ 3,459	$ 3,619	$ 3,785	$ 3,960	$ 4,142	$ 4,332
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 3,307	$ 3,459	$ 3,619	$ 3,785	$ 3,960	$ 4,142	$ 4,332
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 3,307**	**$ 3,459**	**$ 3,619**	**$ 3,785**	**$ 3,960**	**$ 4,142**	**$ 4,332**
Cumulative Cash Flow	**$ (21,135)**	**$ (17,676)**	**$ (14,057)**	**$ (10,272)**	**$ (6,312)**	**$ (2,170)**	**$ 2,162**

PRO FORMA AND PRODUCTION

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Annual Generation (kWh)	17,318	17,232	17,145	$ 17,060	16,974	16,889	16,805

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 4,898	$ 5,118	$ 5,347	$ 5,586	$ 5,836	$ 6,097	$ 6,370
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 4,898	$ 5,118	$ 5,347	$ 5,586	$ 5,836	$ 6,097	$ 6,370
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (10,773)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (11,151)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 4,531	$ (6,034)	$ 4,957	$ 5,185	$ 5,423	$ 5,671	$ 5,931
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 4,531	$ (6,034)	$ 4,957	$ 5,185	$ 5,423	$ 5,671	$ 5,931
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 4,531	$ (6,034)	$ 4,957	$ 5,185	$ 5,423	$ 5,671	$ 5,931
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 4,531**	**$ (6,034)**	**$ 4,957**	**$ 5,185**	**$ 5,423**	**$ 5,671**	**$ 5,931**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 4,531	$ (6,034)	$ 4,957	$ 5,185	$ 5,423	$ 5,671	$ 5,931
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 4,531	$ (6,034)	$ 4,957	$ 5,185	$ 5,423	$ 5,671	$ 5,931
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 4,531**	**$ (6,034)**	**$ 4,957**	**$ 5,185**	**$ 5,423**	**$ 5,671**	**$ 5,931**
Cumulative Cash Flow	**$ 6,693**	**$ 659**	**$ 5,617**	**$ 10,801**	**$ 16,224**	**$ 21,895**	**$ 27,827**

PRO FORMA AND PRODUCTION

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Annual Generation (kWh)	16,721	16,637	16,554	16,471	16,389

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 21	Year 22	Year 23	Year 24	Year 25
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 6,655	$ 6,953	$ 7,264	$ 7,589	$ 7,928
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 6,655	$ 6,953	$ 7,264	$ 7,589	$ 7,928
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 6,203	$ 6,488	$ 6,785	$ 7,095	$ 7,420
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 6,203	$ 6,488	$ 6,785	$ 7,095	$ 7,420
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 6,203	$ 6,488	$ 6,785	$ 7,095	$ 7,420
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 6,203**	**$ 6,488**	**$ 6,785**	**$ 7,095**	**$ 7,420**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 6,203	$ 6,488	$ 6,785	$ 7,095	$ 7,420
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 6,203	$ 6,488	$ 6,785	$ 7,095	$ 7,420
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 6,203**	**$ 6,488**	**$ 6,785**	**$ 7,095**	**$ 7,420**
Cumulative Cash Flow	**$ 34,030**	**$ 40,518**	**$ 47,303**	**$ 54,398**	**$ 61,818**

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 2,773	$ 2,897	$ 3,026	$ 3,162	$ 3,303	$ 3,451
REC Revenue		$ 555	$ 552	$ 549	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 3,327	$ 3,448	$ 3,575	$ 3,162	$ 3,303	$ 3,451
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 3,077	$ 3,191	$ 3,310	$ 2,889	$ 3,022	$ 3,161
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 3,077	$ 3,191	$ 3,310	$ 2,889	$ 3,022	$ 3,161
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 3,077	$ 3,191	$ 3,310	$ 2,889	$ 3,022	$ 3,161
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate		$ -					
Net Income		**$ 3,077**	**$ 3,191**	**$ 3,310**	**$ 2,889**	**$ 3,022**	**$ 3,161**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 3,077	$ 3,191	$ 3,310	$ 2,889	$ 3,022	$ 3,161
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 3,077	$ 3,191	$ 3,310	$ 2,889	$ 3,022	$ 3,161
Cash From Investing							
Installed PV Cost	$ (47,961)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (47,961)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ (47,961)**	**$ 3,077**	**$ 3,191**	**$ 3,310**	**$ 2,889**	**$ 3,022**	**$ 3,161**
Cumulative Cash Flow	**$ (47,961)**	**$ (44,884)**	**$ (41,693)**	**$ (38,383)**	**$ (35,495)**	**$ (32,473)**	**$ (29,311)**

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 3,606	$ 3,767	$ 3,935	$ 4,112	$ 4,296	$ 4,488	$ 4,689
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 3,606	$ 3,767	$ 3,935	$ 4,112	$ 4,296	$ 4,488	$ 4,689
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 3,307	$ 3,459	$ 3,619	$ 3,785	$ 3,960	$ 4,142	$ 4,332
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 3,307	$ 3,459	$ 3,619	$ 3,785	$ 3,960	$ 4,142	$ 4,332
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 3,307	$ 3,459	$ 3,619	$ 3,785	$ 3,960	$ 4,142	$ 4,332
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 3,307**	**$ 3,459**	**$ 3,619**	**$ 3,785**	**$ 3,960**	**$ 4,142**	**$ 4,332**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 3,307	$ 3,459	$ 3,619	$ 3,785	$ 3,960	$ 4,142	$ 4,332
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 3,307	$ 3,459	$ 3,619	$ 3,785	$ 3,960	$ 4,142	$ 4,332
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 3,307**	**$ 3,459**	**$ 3,619**	**$ 3,785**	**$ 3,960**	**$ 4,142**	**$ 4,332**
Cumulative Cash Flow	**$ (26,004)**	**$ (22,545)**	**$ (18,926)**	**$ (15,141)**	**$ (11,181)**	**$ (7,040)**	**$ (2,708)**

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 4,898	$ 5,118	$ 5,347	$ 5,586	$ 5,836	$ 6,097	$ 6,370
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 4,898	$ 5,118	$ 5,347	$ 5,586	$ 5,836	$ 6,097	$ 6,370
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (10,773)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (11,151)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 4,531	$ (6,034)	$ 4,957	$ 5,185	$ 5,423	$ 5,671	$ 5,931
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 4,531	$ (6,034)	$ 4,957	$ 5,185	$ 5,423	$ 5,671	$ 5,931
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 4,531	$ (6,034)	$ 4,957	$ 5,185	$ 5,423	$ 5,671	$ 5,931
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 4,531**	**$ (6,034)**	**$ 4,957**	**$ 5,185**	**$ 5,423**	**$ 5,671**	**$ 5,931**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 4,531	$ (6,034)	$ 4,957	$ 5,185	$ 5,423	$ 5,671	$ 5,931
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 4,531	$ (6,034)	$ 4,957	$ 5,185	$ 5,423	$ 5,671	$ 5,931
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 4,531**	**$ (6,034)**	**$ 4,957**	**$ 5,185**	**$ 5,423**	**$ 5,671**	**$ 5,931**
Cumulative Cash Flow	**$ 1,824**	**$ (4,210)**	**$ 747**	**$ 5,932**	**$ 11,355**	**$ 17,026**	**$ 22,957**

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Scenario B: Taxable Rebate; Pro Forma Project Economics					
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 6,655	$ 6,953	$ 7,264	$ 7,589	$ 7,928
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 6,655	$ 6,953	$ 7,264	$ 7,589	$ 7,928
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 6,203	$ 6,488	$ 6,785	$ 7,095	$ 7,420
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 6,203	$ 6,488	$ 6,785	$ 7,095	$ 7,420
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 6,203	$ 6,488	$ 6,785	$ 7,095	$ 7,420
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate					
Net Income	**$ 6,203**	**$ 6,488**	**$ 6,785**	**$ 7,095**	**$ 7,420**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 6,203	$ 6,488	$ 6,785	$ 7,095	$ 7,420
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 6,203	$ 6,488	$ 6,785	$ 7,095	$ 7,420
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 6,203**	**$ 6,488**	**$ 6,785**	**$ 7,095**	**$ 7,420**
Cumulative Cash Flow	**$ 29,161**	**$ 35,648**	**$ 42,433**	**$ 49,529**	**$ 56,949**

BOSTON CITY HALL

Table 49: Boston City Hall PV Profile

Building	
Building Name	Boston City Hall
Building Address	One City Hall Plaza Boston, MA
City Department	N/A
Number of floors	9
Square footage (if known)	
Fuel Type(s)	
Contact Information	
Facilities Manager	John Sinagra
Phone	(617) 635-4109
Email	John.Sinagra@CityOfBoston.gov
Electrical Connection	
Electric Utility Company	
Floor Plan showing Electrical room	Yes / No
Roof Details	
Roof slope/angle (Flat = 0°)	0°
Roof Orientation (S, SE, SW, etc.)	N/A
Roof Size – Square Feet	
Roof Condition: poor, fair, good, excellent, new	Good
Roof Type (asphalt, shingles, rubber membrane, etc.)	Tar and Gravel
Expected life of roof (years)	
Equipment/obstructions on the roof	If Yes, please describe briefly
Detailed Roof Drawings available	Yes / No

Table 50: Boston City Hall Summary of Findings

Summary of Findings	
Suited for Solar Water Heating?	Yes / No
Site Efficiency	99.50%
Area of roof available for panel installation	
Maximum number of panels that can be installed	
DC Output of maximum number of panels	
Net Capacity Factor (%)	
Cost of Installation:	

Figure 39: Boston City Hall Solar Pathfinder Report

WPI Solar Team and Solar Boston Site Report

Report Name	City Hall 3/19/2008
Report Date	3/21/2008 10:01:54 AM
Declination	-15d 16m
Location	BOSTON, MA, Zipcode: 02201
Lat/Long	42.339 / -70.92
Weather Station	BOSTON, MA, Elevation: 5 m
Site distance	6.12 miles
Array Type	Fixed
Tilt Angle	42.34 deg
Ideal Tilt Angle	0.00 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Make	Evergreen Solar
Panel Model	ES-195-RL
Panel Count	100
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	SinglePicture
Layout Point Count	1

Notes: [None]

Report generated by SolarPathfinder Assistant Version 3.0.7.0. http://www.solarpathfinder.com

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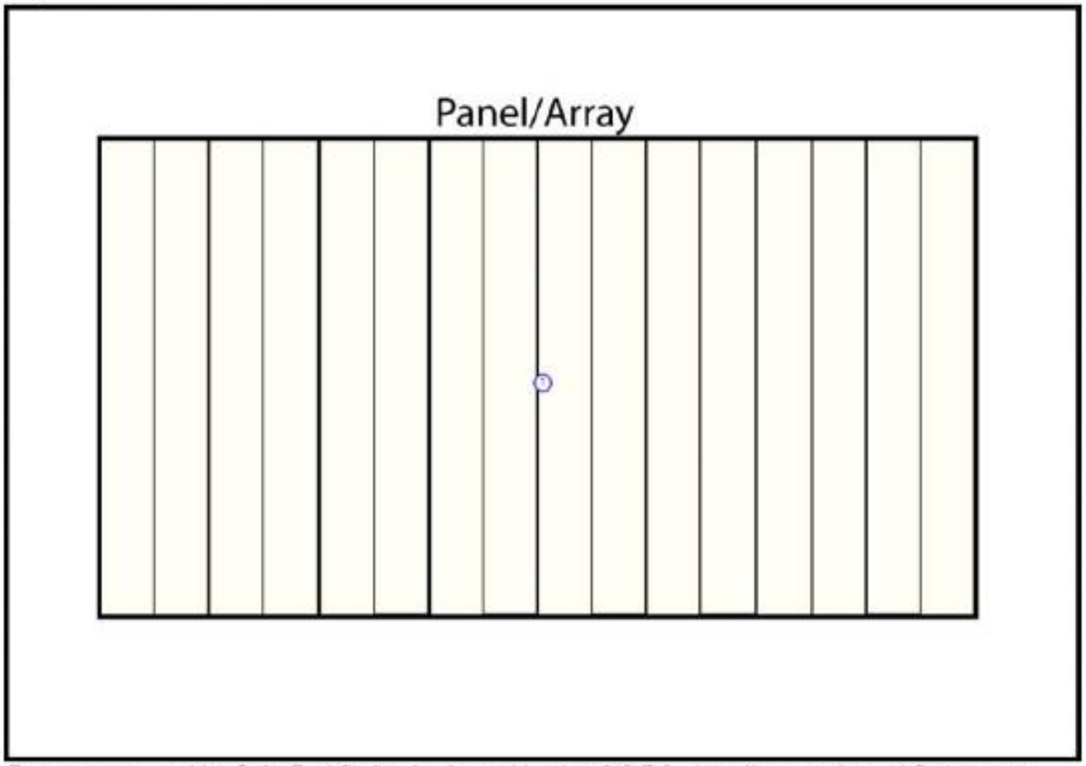
WPI Solar Team and Solar Boston
System Picture Layout

Layout Type Single Picture
Layout Point Count 1



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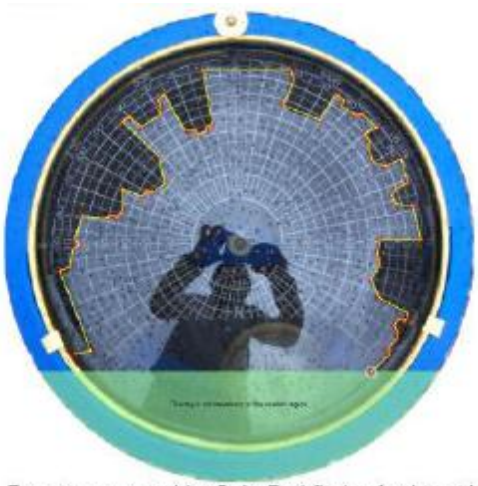
WPI Solar Team and Solar E1st
Solar Site Analysis Report

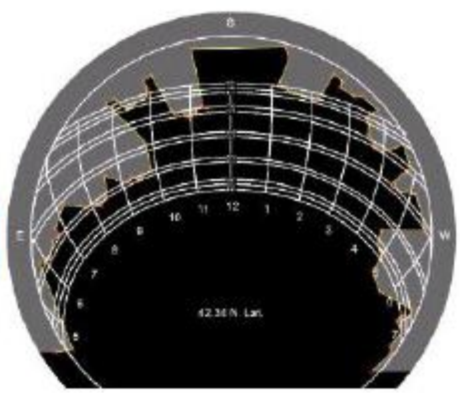
Image File City Hall 3-19 004.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.34	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.34 KWH/m² /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	112.00%	2.07	1698.00	1065.58
February	116.00%	3.23	1988.00	1485.92
March	97.00%	3.68	2327.00	1799.69
April	93.00%	4.29	2262.00	1997.63
May	93.00%	5.17	2418.00	2390.59
June	88.00%	5.29	2292.00	2280.58
July	90.00%	5.44	2446.00	2418.52
August	99.00%	5.40	2482.00	2413.02
September	88.00%	3.74	2240.00	1637.50
October	109.00%	3.45	2171.00	1622.27
November	116.00%	2.20	1472.00	1047.34
December	93.00%	1.47	1470.00	732.18
Totals	**99.56%**	**45.43**	**25266.0**	**20890.83**
	Unweighted Yearly Avg	**Effect: 96.71% Sun Hrs: 3.79**		

Notes: [None]





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WPI Solar Team and Solar Bost Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.34	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.34 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	112.00%	2.07	1698.00	1065.58
February	116.00%	3.23	1988.00	1485.92
March	97.00%	3.68	2327.00	1799.69
April	93.00%	4.29	2262.00	1997.63
May	93.00%	5.17	2418.00	2390.59
June	88.00%	5.29	2292.00	2280.58
July	90.00%	5.44	2446.00	2418.52
August	99.00%	5.40	2482.00	2413.02
September	88.00%	3.74	2240.00	1637.50
October	109.00%	3.45	2171.00	1622.27
November	116.00%	2.20	1472.00	1047.34
December	93.00%	1.47	1470.00	732.18
Totals	**99.50%**	**45.43**	**25266.0**	**20890.82**
	Unweighted	**Effect: 96.71%**		
	Yearly Avg	**Sun Hrs: 3.79**		

Notes: [None]

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APPENDIX L: CONTACT LIST

Contact Name	Company	Address	Phone	Mobile Phone	E-mail
		City of Boston Department Contacts			
Alberque, James	City of Boston Management & Information Services		W: (617) 635-4576		james.alberque@cityofboston.gov
Fazio, Dolores	Boston Redevelopment Authority		W: (617) 918-6209		Dolores.Fazio.BRA@cityofboston.gov
Flynn, Bob	Boston Public Libraries		W: (617) 536-5400		
Flynn, Dennis	Boston Fire Department		W: (617) 343-3312		
Ghirin, Aldo G.	Boson Parks and Recreation		W: (617) 961-3033		aldo.ghirin@cityofboston.gov
Hafner, George	Public Works Department		W: (617) 365-2520		
Harrington, Bob	Boston Public Schools		W: (617) 635-9133		
Helmis, Dan	Boston Housing Authority				
Laizza, Peter	Boston Fire Department		W: (617) 343-3312		
Liotta, Michael C.	Boston Fire Department		W: (617) 343-3312	(617) 828-2022	Michaell.bfd@ci.boston.ma.us
Lynch, Bernie	Boston Parks and Recreation		W: (617) 635-7377		
Lynch, Mark	Boston Police Department		W: (617) 343-4667		
McDonough, Pat	Boston Centers for Youth and Families		W: (617) 635-4920 x 2212	(617) 438-5004	Pat.McDonough@cityofboston.gov
Meade, Jim	Boston Public Libraries			(617) 974-7440	jmeade@bpl.org
Moley, Laura	Boston Redevelopment Authority				
Rickerson, Wilson	City of Boston Environment Department			(302) 388-5742	wilson@rickersonenergy.com
Roy, Rob	Boston Public Schools		W: (617) 635-9133		
Sinagra, John J.	Property Management Department; Boston Community Centers		W: (617) 635-4109	(617) 908-6818	john.sinagra@cityofboston.gov
Smith, Joe	Transportation Department				
Swing, Brad	City of Boston Mayor's Office of Energy and Environmental Services		(617) 635-3425		
Terry, Michael	Boston Centers for Youth and Families		(617) 635-4920 x2320		Michael.Terry@cityofboston.gov

Contact Name	Company	Address	Phone	Mobile Phone	E-mail
		Outdoor Buildings/Pools			
Dave Martell	Clougherty Pool	349 Bunker Hill St. Charleston	636-6169		
Martha Salamenca	Curtis Hall Pool	20 South St, J.P.	635-5193		
Tony Rosario	Draper Pool	5279 Washington St, W.R	635-5021		
Denis Wilson	Flaherty Pool	160 Florence St, Roslindale	635-5181		
Denise Coles	Mason Pool	176 Norfolk Ave. Roxbury	635-5241		
Tony Roasrio	Mirabella Pool	475 Commercial St, North end	635-5021		
Joe Weddleton	Paris Street Pool	113 Paris St. East Boston	635-5128		
Cynthia johnson	Archdale Center	125 Brookway Rd, Roslindale	635-5256		
Yamile Melor	City Hall Daycare	1 City Hall Boston	635-3793		
	Curley, L Street	1663 Columbia Rd, South Boston	635-5104		
David Hinton	Gallivan Center	61 Woodruff Way, Mattapan	636-5252		
Robert McGann	Golden Age Center	283 Main Street , Charlestown	635-5175		
Bob Hickey	Hyde Park Center	1179 River St, Hyde Park	635-5178		
Carl Ameno	Nazzaro Center	30 North Bennet St. North End	635-5166		
Lynne Jackson	Orchard Garden	2 Dearborne St, Roxbury	635-5240		
Jack	Orient Heights	86 Boardman St. East Boston	635-5120		
Helen Allix	Pal/Walsh Gym	535 East Broadway St South Boston	635-5640		
Joe Weddleton	Paris Street Center	112 Paris St. East Boston	635-5128		
Laruen Hurley	Roche Center	1716 Centre St. W.R.	635-5066		
	Roslindale Center	6 Cummings Highway, Roslindale	635-5185		
Cherie Cope	Shelburne Center	2730 Washington St. Roxbury	635-5213		
Robert McGann	Stillman Tennis Center	50 Terminal St. Charlestown	635-5375		
Michael Ware	Thomas Johnson/Mission	68 Annuciation Rd. Mission Hill	635-5316		
Michael Ware	Tobin/Mission Hill	1481 Tremont St. Mission Hill	635-5216		
	Vine Street Center	339 Dudley St. Roxbury	635-1285		
	Strand Theater		(857) 594-0669		
Tom Hartman	Bragdon St	95 Bragdon St. Roxbury	(617) 759-1811		
Pat	Parkman House	33 Beacon St. Boston	635-0440		
	200 Frontage Rd. PWD	200 Frontage Rd Boston			
	Southampton St TPD	112 Southampton St Roxbury			

Contact Name	Company	Address	Phone	Mobile Phone	E-mail
Local Resources					
Carroll, Lee	North Coast Seafoods		W: (617) 593-8673		lcarroll@northcoastseafoods.com
Childers, Richard	Konarka Technologies, Inc.		W: (978) 569-1444		RChilders@Konarka.com
Duran, Sandra	DND				
Fraley, Lynda	City's Loss Prevention Program		W: x4344		
Iacovino, Stephen	Merchandise Mart Properties, Inc.		W: (617) 449-5507		siacovino@mmart.com
Leeds, Tyler	Massachusetts Technology Collaborative		W: (508) 870-0312 x 1273		leeds@masstech.org

Contact Name	Company	Address	Phone	Mobile Phone	E-mail
Electric Companies					
McDonnell, Patrick	NStar				patrick.mcdonell@nstar.com
Gudell, Jan	NStar				jan.gudell@nstar.com

APPENDIX M: SOLAR WATER HEATING SITE PROPOSAL AND PROFILES

SolarBoston

PROPOSAL

City of Boston Sites for Solar Water Heating Analysis

As part of the City of Boston's Solar City Partnership with the US Department of Energy, the City has identified five locations in the Boston Centers for Youth and Families (BCYF) system that could be good sites for solar water heating installations. The City selected these buildings for further analysis because they have the highest heading usage per square foot of any of the BCYF properties based on the results of the City's Integrated Energy Management Plan survey. Heating demand in these buildings is driven largely by water heating at these locations. Solar water heating can be a cost-effective strategy to reduce pool heating demand. The City of Boston would like to request **$50,000 in technical assistance** from the Massachusetts Division of Energy Resources to conduct full technical and economic feasibility studies of solar water heating installations at these five locations.

Preliminary energy profiles of these facilities are included below, each accompanied with an aerial view of the location. The electrical loads were examined for some of these locations for a separate PV application, but these loads are much smaller than that for heating. For example, at Draper Pool in West Roxbury, the electrical load was 18.3 kWh/sq ft/yr, whereas the heating load was 286.5 Mbtu/sq ft/yr. In terms of energy conversion, one Mbtu is approximately one million Btu, and one Btu is approximately 0.0003 kWh. The locations are listed from highest energy usage to lowest energy usage in terms of heating loads required.

BOSTON GREEN BUILDING

THOMAS M. MENINO
MAYOR

SOLAR AMERICA CITY 2007

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DRAPER POOL

Figure 40: Draper Pool Aerial View

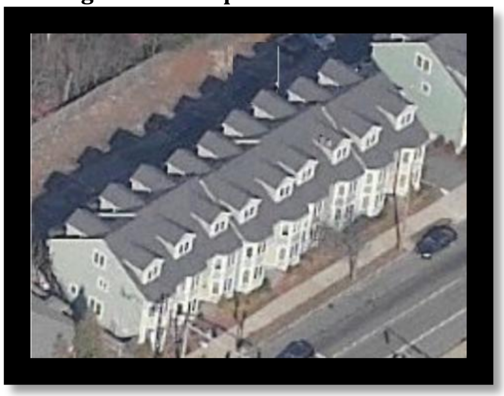

Table 51: Draper Pool SWH Profile

Address:	5279 Washington Street West Roxbury, MA 02132
Department:	Boston Center for Youth and Families
Facility Manager:	
Phone Number:	
Roof Size:	
Fuel Type:	
Heating Usage:	286.5 Mbtu/sq ft/yr

FLAHERTY POOL

Figure 41: Flaherty Pool Aerial View

Table 52: Flaherty Pool SWH Profile

Address:	160 Florence Street Roslindale, MA 02131
Department:	Boston Center for Youth and Families

Facility Manager:	
Phone Number:	
Roof Size:	
Fuel Type:	
Heating Usage:	229.6 Mbtu/sq ft/yr

MASON POOL

Figure 42: Mason Pool Aerial View

Table 53: Mason Pool SWH Profile

Address:	5279 Washington Street West Roxbury, MA 02132
Department:	Boston Center for Youth and Families
Facility Manager:	
Phone Number:	
Roof Size:	
Fuel Type:	
Heating Usage:	214.6 Mbtu/sq ft/yr

CURTIS HALL COMMUNITY CENTER

Figure 43: Curtis Hall Community Center

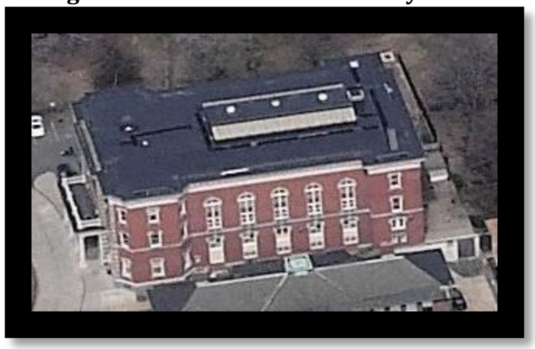

Table 54: Curtis Hall Community Center SWH Profile

Address:	20 South Street Jamaica Plain, MA 02130
Department:	Boston Center for Youth and Families
Facility Manager:	
Phone Number:	
Roof Size:	
Fuel Type:	
Heating Usage:	133.0 Mbtu/sq ft/yr

ROSLINDALE COMMUNITY CENTER

Figure 44: Roslindale Community Center Aerial View

Table 55: Roslindale Community Center SWH Profile

Address:	6 Cummins Way Boston, MA
Department:	Boston Center for Youth and Families
Facility Manager:	

Phone Number:	
Roof Size:	
Fuel Type:	
Heating Usage:	118.7 Mbtu/sq ft/yr

SHELBURNE COMMUNITY CENTER

Figure 45: Shelburne Community Center Aerial View

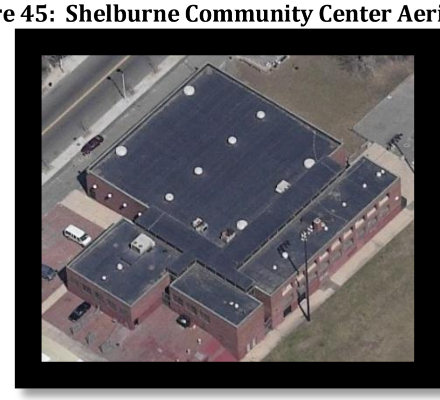

Table 56: Shelburne Community Center SWH Profile

Address:	2730 Washington Street Roxbury, MA 02119
Department:	Boston Center for Youth and Families
Facility Manager:	Cherie Cope
Phone Number:	(617) 635-5213
Roof Size:	
Fuel Type:	
Heating Usage:	

PARIS STREET COMMUNITY CENTER

Figure 46: Paris Street Community Center Aerial View

Table 57: Paris Street Community Center SWH Profile

Address:	112 Paris Street East Boston, MA 02128
Department:	Boston Center for Youth and Families
Facility Manager:	Joe Weddleton
Phone Number:	(617) 635-5125
Email Address:	Joe@ParisStreet.org
Roof Size:	
Fuel Type:	
Heating Usage:	

PARIS STREET POOL

Table 58: Paris Street Pool SWH Profile

Address:	113 Paris Street East Boston, MA 02128
Department:	Boston Center for Youth and Families
Facility Manager:	Joe Weddleton
Phone Number:	(617) 635-5125
Email Address:	Joe@ParisStreet.org
Roof Size:	
Fuel Type:	
Heating Usage:	

ANIMAL SHELTER

Figure 47: Animal Shelter Aerial View

Table 59: Animal Shelter SWH Profile

Address:	26 Mahler Road Roslindale, MA 02131
Department:	Boston Animal Control

Facility Manager:	
Phone Number:	(617) 635-5125
Roof Size:	
Fuel Type:	
Heating Usage:	

BRIGHTON HIGH SCHOOL

Figure 48: Brighton High School Aerial View

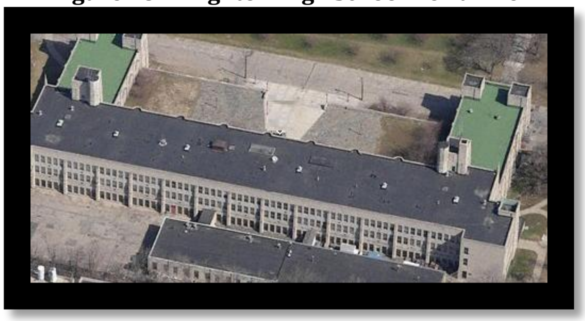

Table 60: Brighton High School SWH Profile

Address:	25 Warren Street Brighton, MA 02135
Department:	Boston Public Schools
Facility Manager:	
Phone Number:	
Roof Size:	216213 sq ft
Fuel Type:	
Heating Usage:	802,547 kWh/yr

MILDRED AVENUE MIDDLE SCHOOL

Figure 49: Mildred Ave Middle School Aerial View

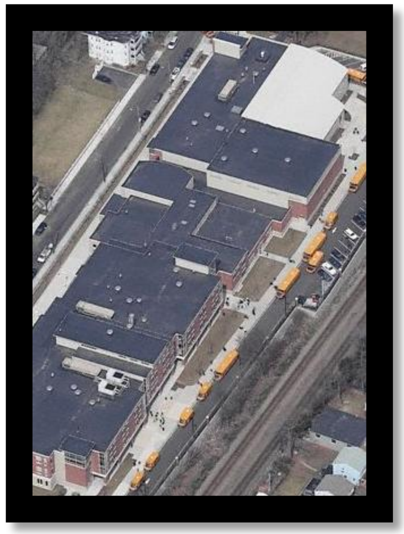

Table 61: Mildred Avenue Middle School SWH Profile

Address:	5-7 Mildred Avenue Mattapan, MA 02126
Department:	Boston Public Schools
Facility Manager:	
Phone Number:	
Roof Size:	172,000 sq ft
Fuel Type:	
Heating Usage:	1,669,860 kWh/yr

CURLEY COMMUNITY CENTER

Figure 50: Curley Community Center Aerial View

Table 62: Curley Community Center SWH Profile

Address:	1663 Columbia Road South Boston, MA 02127

Department:	Boston Center for Youth and Families
Facility Manager:	
Phone Number:	
Roof Size:	73,035 sq ft
Fuel Type:	
Heating Usage:	536,688 kWh/yr

POLICE HEADQUARTERS

Figure 51: Police Headquarters Aerial View

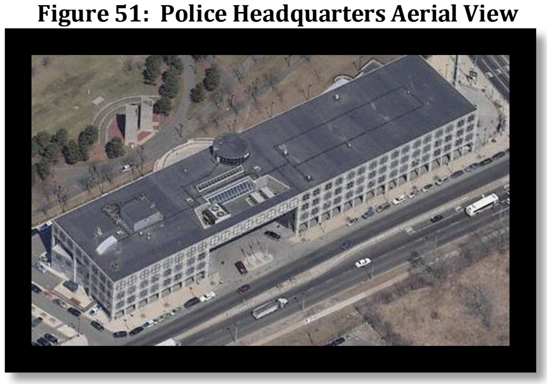

Table 63: Police Headquarters SWH Profile

Address:	1 Schroeder Plaza Boston, MA 02120
Department:	Boston Police Department
Facility Manager:	
Phone Number:	
Roof Size:	
Fuel Type:	
Heating Usage:	

ENGINE 39 STATION

Figure 52: Engine 39 Station Aerial View

Table 64: Engine 39 SWH Profile

Address:	272 D. Street S. Boston, MA
Department:	Boston Fire Department
Facility Manager:	
Phone Number:	
Roof Size:	
Fuel Type:	
Heating Usage:	

ENGINE 9 STATION

Figure 53: Engine 9 Station Aerial View

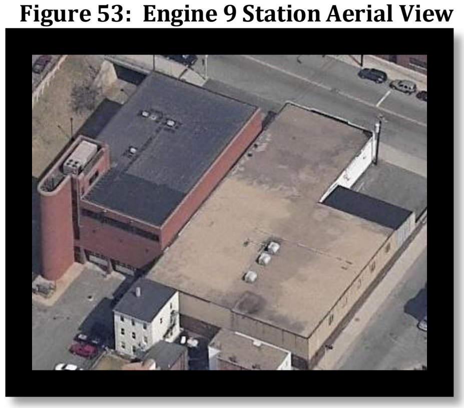

Table 65: Engine 9 SWH Profile

Address:	239 Sumner Street East Boston, MA
Department:	Boston Fire Department
Facility Manager:	
Phone Number:	

Roof Size:	
Fuel Type:	
Heating Usage:	

APPENDIX N: ANALYSES OF OTHER SITES VISITED

During the course of our investigations, we visited an additional five facilities, all of which are located in Boston's South End. The first four (12 Drydock Ave, 22 Drydock Ave, 12 Channel St, and the Boston Design Center) are located in Marine Industrial Park. The purpose of the investigations was to become familiar with the Solar Pathfinder equipment and software as well as providing us with an opportunity to develop a system of analysis while setting up appointments at our key facilities. The facilities listed below will also offer the City an opportunity for alternate sites to install photovoltaic arrays if the need and funds arise.

12 DRYDOCK AVENUE

Table 66: 12 Drydock Ave PV Profile

Building	
Building Name	Parking Garage
Building Address	12 Drydock Avenue Boston, MA
City Department	Boston Redevelopment Authority
Number of floors	5
Square footage (if known)	
Fuel Type(s)	Electricity / Natural Gas
Contact Information	
Facilities Manager	Dolores Fazio
Phone	(617) 918-6209
Email	Dolores.Fazio.BRA@CityOfBoston.gov
Electrical Connection	
Electric Utility Company	
Floor Plan showing Electrical room	Yes / No
Roof Details	
Roof slope/angle (Flat = 0^o)	0^o
Roof Orientation (S, SE, SW, etc.)	N/A
Roof Size – Square Feet	sq ft
Roof Condition: poor, fair, good, excellent, new	Good
Roof Type (asphalt, shingles, rubber membrane, etc.)	Concrete
Expected life of roof (years)	
Equipment/obstructions on the roof	Covered Stairwells – Platforms would also need to be installed in order to mount the panels
Detailed Roof Drawings available	Yes / No

Table 67: 12 Drydock Ave Summary of Findings

Summary of Findings	
Suited for Solar Water Heating?	No
Shading on Roof (%)	0.58% Shaded
Area of roof available for panel installation	
number of panels for assessment	100 panels
DC Output of number of panels in assessment	19,500 W
Net Capacity Factor (%)	13.2%
Cost of Installation:	$9,534

Figure 54: 12 Drydock Avenue Solar Pathfinder Report

Site Report

Report Name	12 Drydock Garage
Report Date	3/25/2008 10:51:53 AM
Declination	-15d 13m
Location	BOSTON, MA, Zipcode: 02210
Lat/Long	42.348 / -71.041
Weather Station	Boston, MA, Elevation: 6 m
Site distance	1.34 miles
Array Type	Fixed
Tilt Angle	42.35 deg
Ideal Tilt Angle	43.00 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Count	100
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	SinglePicture
Layout Point Count	1

Notes: [None]

Report generated by SolarPathfinder Assistant Version 3.0.7.0. http://www.solarpathfinder.com

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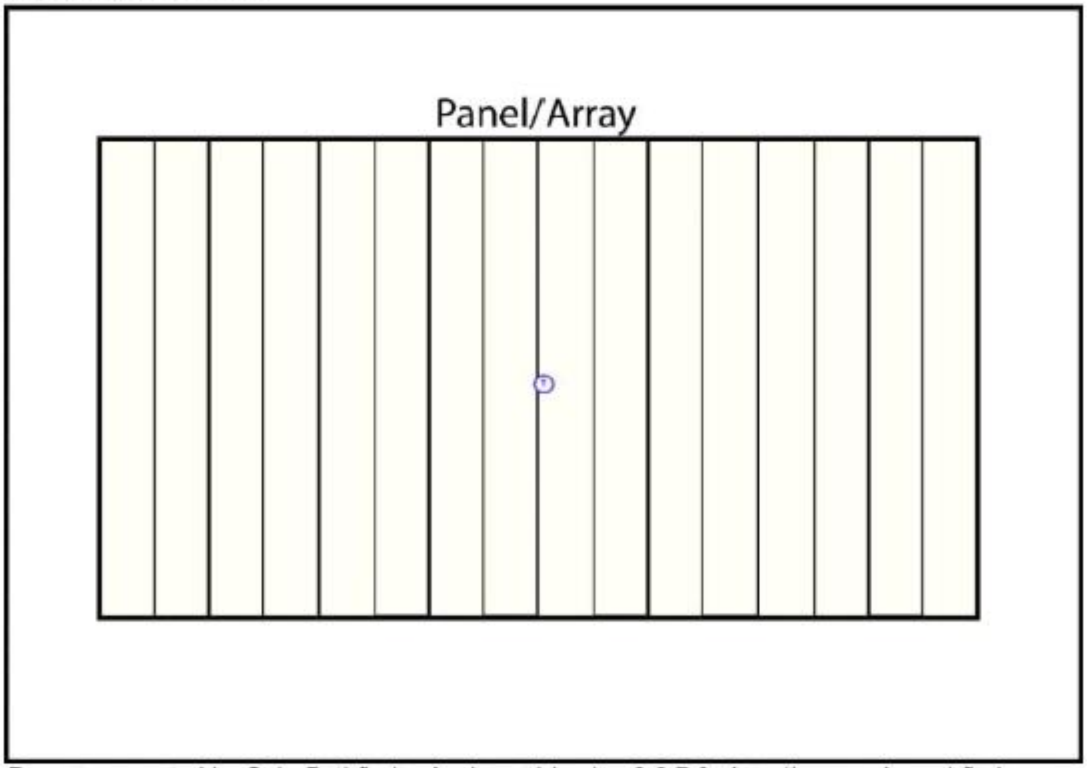
System Picture Layout

Layout Type Single Picture
Layout Point Count 1



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Solar Site Analysis Report

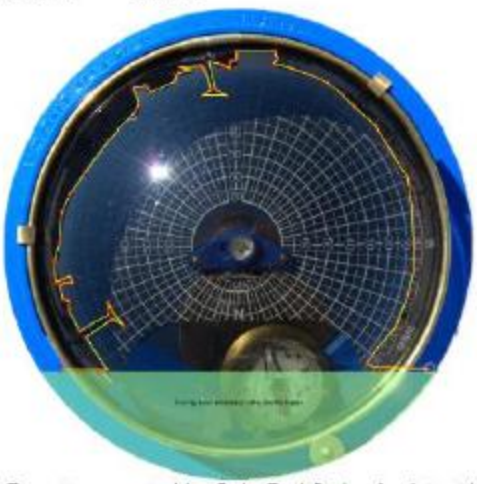
1

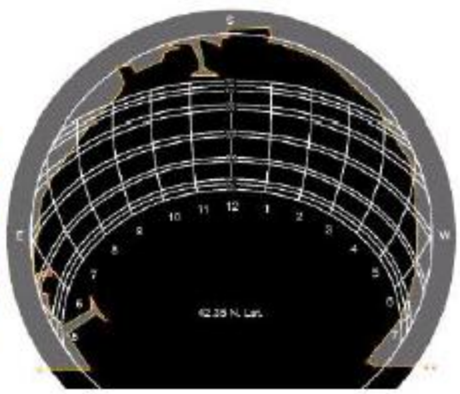
Image File Marine Industrial Park 12 Drydock Ave 3-24 018.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	97.00%	2.41	1242.00	1224.53
February	98.00%	3.27	1465.00	1453.90
March	99.00%	4.17	2041.00	2038.91
April	100.00%	4.49	2032.00	2032.00
May	100.00%	5.09	2316.00	2315.36
June	100.00%	5.70	2426.00	2425.70
July	100.00%	5.35	2337.00	2336.70
August	100.00%	5.04	2225.00	2225.00
September	99.00%	5.11	2258.00	2250.64
October	99.00%	3.81	1775.00	1760.90
November	95.00%	2.61	1272.00	1226.17
December	94.00%	2.20	1164.00	1111.75
Totals	**98.34%**	**49.25**	**22553.0**	**22401.56**
	Unweighted Yearly Avg	**Effect: 98.82% Sun Hrs: 4.10**		

Notes: [None]





Report generated by SolarPathfinder Assistant Version 3.0.7.0. http://www.solarpathfinder.com
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Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	97.00%	2.41	1242.00	1224.53
February	98.00%	3.27	1465.00	1453.90
March	99.00%	4.17	2041.00	2038.91
April	100.00%	4.49	2032.00	2032.00
May	100.00%	5.09	2316.00	2315.36
June	100.00%	5.70	2426.00	2425.70
July	100.00%	5.35	2337.00	2336.70
August	100.00%	5.04	2225.00	2225.00
September	99.00%	5.11	2258.00	2250.64
October	99.00%	3.81	1775.00	1760.90
November	95.00%	2.61	1272.00	1226.17
December	94.00%	2.20	1164.00	1111.75
Totals	**98.42%**	**49.25**	**22553.0**	**22401.56**
	Unweighted	**Effect: 98.82%**		
	Yearly Avg	**Sun Hrs: 4.10**		

Notes: [None]

Report generated by SolarPathfinder Assistant Version 3.0.7.0. http://www.solarpathfinder.com
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Table 68: 12 Drydock Ave MTC Rebate Estimator Summary

Commonwealth Solar Non-Residential Solar Photovoltaic Calculator

Non-Residential: Commonwealth Solar Rebate Matrix ($/watt dc)				
Incremental Capacity	**1 to 25 kW** (1,000 to 25,000 watts)	**> 25 to 100 kW**	**> 100 kW to 200 kW**	**> 200 kW to 500 kW**
Base Incentive ($/watt dc)	$3.25	$2.50	$2.00	$1.50
PLUS: Additions to Base				
MA-Manufactured Components	$0.25	$0.25	$0.25	$0.25
Public Building Adder	$0.50	$0.50	$0.25	$0.25

Non-Residential: Commonwealth Solar Rebate Calculator	
Total PV Project Size (watts dc)	3178
Total PV Project Size for Rebate Calculation (500 kW cap)	**3,178**
MA-manufactured components	YES
Public Building Adder	YES
Rebate ($)	**$ 12,712.00**
Rebate ($/watt dc) based on total project size	**$ 4.00000**
Key	
Entry Cells	
Calculation Cells (not for Entry)	

Click here for Financial Model

DATA ENTRY AND FINANCIAL SUMMARY

Key

Entry Cells	
Cells Draw Data from Another Worksheet	
Calculation Cells (Not for Entry)	

Select Taxable or Non-Taxable Entity	Non-Taxable	
Project and Customer Cost Assumptions		
Solar Photovoltaic System Size	3,178	Watts (DC STC)
Total System Cost/Watt	$ 7.00	$/Watt (DC STC)
Total System Cost	$ 22,246	
MTC Rebate Assumptions		
MTC Scenario A: Non-Taxable Rebate	$ 4.000	$/Watt (DC STC)
Scenario A Rebate	$ 12,712	
MTC Scenario B: Taxable Rebate	$ 5.161	$/Watt (DC STC)
Scenario B Rebate	$ 16,402	
Project Performance and Savings/ Cost Assumptions		
Annual Net Capacity Factor	13.0%	kW (DC STC) to kWh AC
Annual Production Degradation	0.50%	%
Project Life	25	Years
Electricity Revenue (Avoided Costs)	$ 0.15	$/kWh
Electricity Revenue (Avoided Costs) Annual Adjustor	5.0%	%
Renewable Energy Certificate (REC) Revenue	$ 0.03	$/kWh
REC Revenue Annual Adjustor	0.0%	%
REC Revenue Term	3	Years (must be equal to or less than project life)
Annual Operations and Maintenance Cost	$ 250	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.75	$/Watt (DC STC)
Inverter Life, Replace Every X Years	15	Year (must be equal to or less than project life)

Scenario Definitions

Scenario A: Non-Taxable Rebate - Assumes that the state rebate is non-taxable, but is subtracted from the cost basis for purposes of

Scenario B: Taxable Rebate - Assumes that the state rebate is taxable, but is not subtracted from the cost basis for purposes of deter

Both Scenarios assume that the project owner can use both federal and state tax benefits

Tax Assumptions

Federal Tax Rate	0%					
State Tax Rate	0%					
Effective Tax Rate	0%					
Federal Tax Credit	0%					
State Tax Deduction	0%					
5 Year Accelerated Depreciation Schedule (MACRS)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Financing Assumptions

% Financed w/ Cash	100%	
% Financed w/ Loan	0%	
Loan Interest Rate	8%	
Loan Period	20	Years (must be equal to or less than project life)
Scenario A Net Cost	$ 9,534	
Scenario A Loan	$ -	
Scenario B Net Cost	$ 5,844	
Scenario B Loan	$ -	
Customer Discount Rate	6%	

Solar Project Financial Analysis Summary	
Scenario A: Net Present Value	**$ (3,689)**
Scenario A: Simple Payback (100% Cash only)	**Year 22**
Scenario A: Estimated Return on Equity	**#DIV/0!**
Scenario A: Guess Return on Equity	50%
Scenario B: Net Present Value	**$ 1**
Scenario B: Simple Payback (100% Cash only)	**Year 14**
Scenario B: Estimated Return on Equity	**#DIV/0!**
Scenario B: Guess Return on Equity	50%

PRO FORMA AND PRODUCTION

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Annual Generation (kWh)		3,619	3,601	3,583	3,565	3,547	3,530

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 543	$ 567	$ 593	$ 619	$ 647	$ 676
REC Revenue		$ 109	$ 108	$ 107	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 651	$ 675	$ 700	$ 619	$ 647	$ 676
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Net Income		**$ 401**	**$ 418**	**$ 435**	**$ 346**	**$ 365**	**$ 386**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Cash From Investing							
Installed PV Cost	$ (9,534)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (9,534)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ (9,534)**	**$ 401**	**$ 418**	**$ 435**	**$ 346**	**$ 365**	**$ 386**
Cumulative Cash Flow	**$ (9,534)**	**$ (9,133)**	**$ (8,715)**	**$ (8,280)**	**$ (7,934)**	**$ (7,569)**	**$ (7,183)**

PRO FORMA AND PRODUCTION

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Annual Generation (kWh)	3,512	3,494	3,477	3,459	3,442	3,425	3,408

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 706	$ 738	$ 771	$ 805	$ 841	$ 879	$ 918
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 706	$ 738	$ 771	$ 805	$ 841	$ 879	$ 918
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 407**	**$ 430**	**$ 454**	**$ 479**	**$ 505**	**$ 533**	**$ 562**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 407**	**$ 430**	**$ 454**	**$ 479**	**$ 505**	**$ 533**	**$ 562**
Cumulative Cash Flow	**$ (6,776)**	**$ (6,345)**	**$ (5,892)**	**$ (5,413)**	**$ (4,908)**	**$ (4,375)**	**$ (3,814)**

PRO FORMA AND PRODUCTION

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Annual Generation (kWh)	3,391	3,374	3,357	$ 3,340	3,323	3,307	3,290

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 959	$ 1,002	$ 1,047	$ 1,094	$ 1,143	$ 1,194	$ 1,247
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 959	$ 1,002	$ 1,047	$ 1,094	$ 1,143	$ 1,194	$ 1,247
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (2,384)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (2,762)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 592**	**$ (1,760)**	**$ 657**	**$ 693**	**$ 729**	**$ 768**	**$ 809**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 592**	**$ (1,760)**	**$ 657**	**$ 693**	**$ 729**	**$ 768**	**$ 809**
Cumulative Cash Flow	**$ (3,222)**	**$ (4,981)**	**$ (4,324)**	**$ (3,631)**	**$ (2,902)**	**$ (2,134)**	**$ (1,325)**

PRO FORMA AND PRODUCTION

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Annual Generation (kWh)	3,274	3,258	3,241	3,225	3,209

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 21	Year 22	Year 23	Year 24	Year 25
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 1,303	$ 1,361	$ 1,422	$ 1,486	$ 1,552
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,303	$ 1,361	$ 1,422	$ 1,486	$ 1,552
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 851	$ 896	$ 943	$ 992	$ 1,044
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 851	$ 896	$ 943	$ 992	$ 1,044
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 851	$ 896	$ 943	$ 992	$ 1,044
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 851**	**$ 896**	**$ 943**	**$ 992**	**$ 1,044**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 851	$ 896	$ 943	$ 992	$ 1,044
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 851	$ 896	$ 943	$ 992	$ 1,044
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 851**	**$ 896**	**$ 943**	**$ 992**	**$ 1,044**
Cumulative Cash Flow	**$ (474)**	**$ 423**	**$ 1,366**	**$ 2,358**	**$ 3,402**

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 543	$ 567	$ 593	$ 619	$ 647	$ 676
REC Revenue		$ 109	$ 108	$ 107	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 651	$ 675	$ 700	$ 619	$ 647	$ 676
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate		$ -					
Net Income		**$ 401**	**$ 418**	**$ 435**	**$ 346**	**$ 365**	**$ 386**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Cash From Investing							
Installed PV Cost	$ (5,844)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (5,844)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ (5,844)**	**$ 401**	**$ 418**	**$ 435**	**$ 346**	**$ 365**	**$ 386**
Cumulative Cash Flow	**$ (5,844)**	**$ (5,443)**	**$ (5,025)**	**$ (4,590)**	**$ (4,245)**	**$ (3,879)**	**$ (3,493)**

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 706	$ 738	$ 771	$ 805	$ 841	$ 879	$ 918
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 706	$ 738	$ 771	$ 805	$ 841	$ 879	$ 918
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 407**	**$ 430**	**$ 454**	**$ 479**	**$ 505**	**$ 533**	**$ 562**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 407**	**$ 430**	**$ 454**	**$ 479**	**$ 505**	**$ 533**	**$ 562**
Cumulative Cash Flow	**$ (3,086)**	**$ (2,656)**	**$ (2,202)**	**$ (1,723)**	**$ (1,218)**	**$ (685)**	**$ (124)**

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 959	$ 1,002	$ 1,047	$ 1,094	$ 1,143	$ 1,194	$ 1,247
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 959	$ 1,002	$ 1,047	$ 1,094	$ 1,143	$ 1,194	$ 1,247
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (2,384)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (2,762)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 592**	**$ (1,760)**	**$ 657**	**$ 693**	**$ 729**	**$ 768**	**$ 809**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 592**	**$ (1,760)**	**$ 657**	**$ 693**	**$ 729**	**$ 768**	**$ 809**
Cumulative Cash Flow	**$ 468**	**$ (1,292)**	**$ (634)**	**$ 58**	**$ 788**	**$ 1,556**	**$ 2,365**

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Scenario B: Taxable Rebate; Pro Forma Project Economics					
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 1,303	$ 1,361	$ 1,422	$ 1,486	$ 1,552
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,303	$ 1,361	$ 1,422	$ 1,486	$ 1,552
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 851	$ 896	$ 943	$ 992	$ 1,044
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 851	$ 896	$ 943	$ 992	$ 1,044
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 851	$ 896	$ 943	$ 992	$ 1,044
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate					
Net Income	**$ 851**	**$ 896**	**$ 943**	**$ 992**	**$ 1,044**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 851	$ 896	$ 943	$ 992	$ 1,044
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 851	$ 896	$ 943	$ 992	$ 1,044
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 851**	**$ 896**	**$ 943**	**$ 992**	**$ 1,044**
Cumulative Cash Flow	**$ 3,216**	**$ 4,112**	**$ 5,055**	**$ 6,048**	**$ 7,092**

22 DRYDOCK AVENUE

Table 69: 22 Drydock Ave PV Profile

Building	
Building Name	Boston Technical Center
Building Address	22 Drydock Avenue Boston, MA
City Department	Boston Redevelopment Authority
Number of floors	4
Square footage (if known)	
Fuel Type(s)	Electricity / Natural Gas
Contact Information	
Facilities Manager	Dolores Fazio
Phone	(617) 918-6209
Email	Dolores.Fazio.BRA@CityOfBoston.gov
Electrical Connection	
Electric Utility Company	
Floor Plan showing Electrical room	Yes / No
Roof Details	
Roof slope/angle (Flat = 0°)	0°
Roof Orientation (S, SE, SW, etc.)	N/A
Roof Size – Square Feet	
Roof Condition: poor, fair, good, excellent, new	Good
Roof Type (asphalt, shingles, rubber membrane, etc.)	Tar and Gravel
Expected life of roof (years)	
Equipment/obstructions on the roof	Covered Stairwell
Detailed Roof Drawings available	Yes / No

Table 70: 22 Drydock Ave Summary of Findings

Summary of Findings	
Suited for Solar Water Heating?	No
Shading on Roof (%)	4.61%
Area of roof available for panel installation	
Number of panels for assessment	100 panels
DC Output of number of panels in assessment	19,500 W
Net Capacity Factor (%)	13.2%
Cost of Installation:	$9,405

Figure 55: 22 Drydock Avenue Solar Pathfinder Report

Site Report

Report Name	22 Drydock
Report Date	3/25/2008 10:18:07 AM
Declination	-15d 13m
Location	BOSTON, MA, Zipcode: 02210
Lat/Long	42.348 / -71.041
Weather Station	Boston, MA, Elevation: 6 m
Site distance	1.34 miles
Array Type	Fixed
Tilt Angle	42.35 deg
Ideal Tilt Angle	43.00 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Count	100
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	SinglePicture
Layout Point Count	1

Notes: [None]

Report generated by SolarPathfinder Assistant Version 3.0.7.0. http://www.solarpathfinder.com

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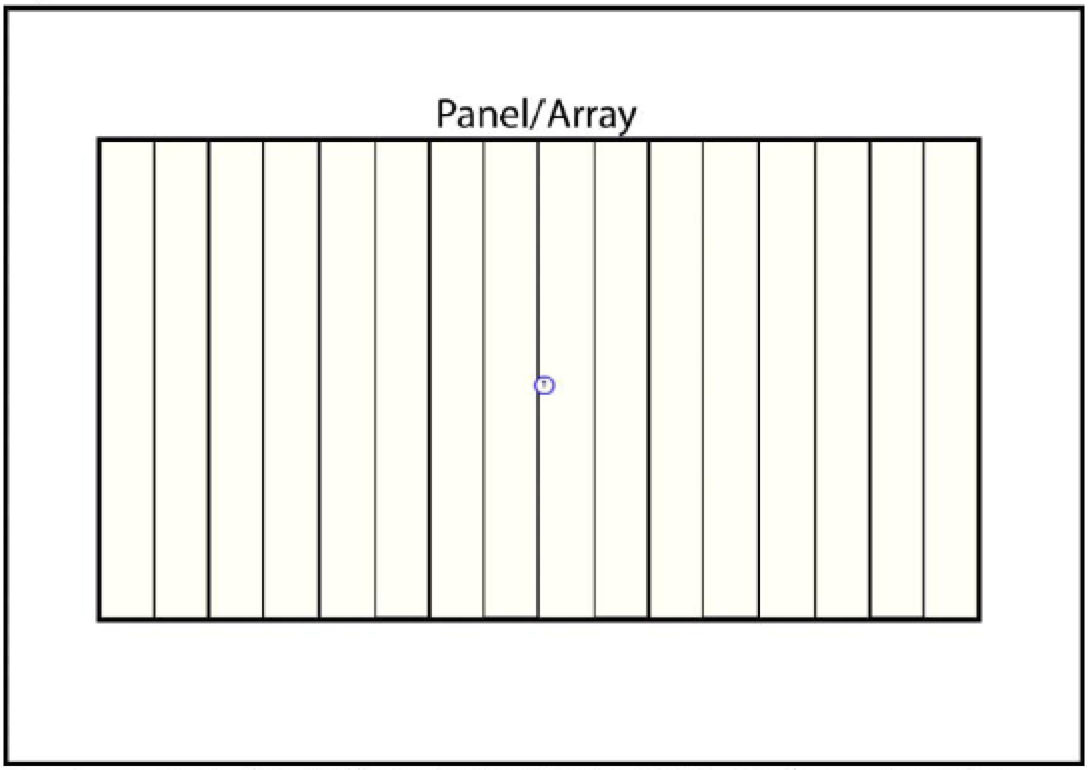
System Picture Layout

Layout Type Single Picture
Layout Point Count 1



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Solar Site Analysis Report

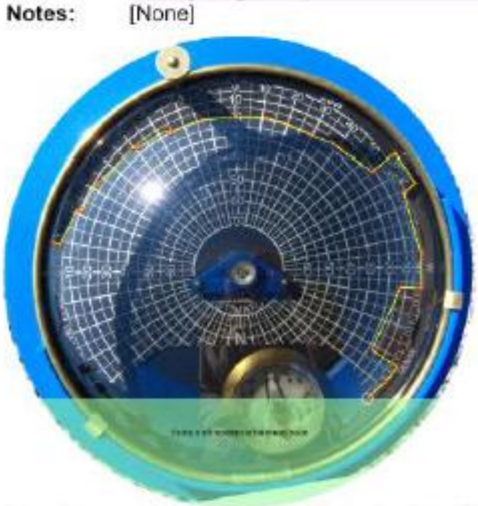
1

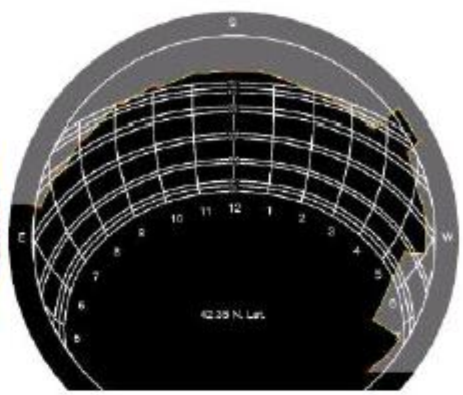
Image File Marine Industrial Park 22 Drydock3-24 001.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	87.00%	2.17	1242.00	1102.48
February	98.00%	3.25	1465.00	1449.22
March	100.00%	4.19	2041.00	2041.00
April	100.00%	4.48	2032.00	2030.40
May	99.00%	5.04	2316.00	2305.01
June	99.00%	5.62	2426.00	2413.08
July	99.00%	5.30	2337.00	2326.75
August	99.00%	5.02	2225.00	2219.16
September	100.00%	5.14	2258.00	2257.78
October	99.00%	3.81	1775.00	1760.90
November	91.00%	2.51	1272.00	1176.70
December	75.00%	1.76	1164.00	890.94
Totals	**95.39%**	**48.29**	**22553.0**	**21973.42**
	Unweighted	**Effect: 96.91%**		
	Yearly Avg	**Sun Hrs: 4.02**		

Notes: [None]





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Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	87.00%	2.17	1242.00	1102.48
February	98.00%	3.25	1465.00	1449.22
March	100.00%	4.19	2041.00	2041.00
April	100.00%	4.48	2032.00	2030.40
May	99.00%	5.04	2316.00	2305.01
June	99.00%	5.62	2426.00	2413.08
July	99.00%	5.30	2337.00	2326.75
August	99.00%	5.02	2225.00	2219.16
September	100.00%	5.14	2258.00	2257.78
October	99.00%	3.81	1775.00	1760.90
November	91.00%	2.51	1272.00	1176.70
December	75.00%	1.76	1164.00	890.94
Totals	**95.50%**	**48.29**	**22553.0**	**21973.42**
	Unweighted	**Effect: 96.91%**		
	Yearly Avg	**Sun Hrs: 4.02**		

Notes: [None]

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Site Report

Report Name	22 Drydock
Report Date	3/25/2008 10:18:07 AM
Declination	-15d 13m
Location	BOSTON, MA, Zipcode: 02210
Lat/Long	42.348 / -71.041
Weather Station	Boston, MA, Elevation: 6 m
Site distance	1.34 miles

Array Type	Fixed
Tilt Angle	42.35 deg
Ideal Tilt Angle	43.00 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg

Panel Count	100
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800

Layout Configuration	SinglePicture
Layout Point Count	1

Notes: [None]
Report generated by SolarPathfinder Assistant Version 3.0.7.0. http://www.solarpathfinder.com
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Table 71: 22 Drydock Ave MTC Rebate Estimator Summary

Commonwealth Solar Non-Residential Solar Photovoltaic Calculator

Non-Residential: Commonwealth Solar Rebate Matrix ($/watt dc)				
Incremental Capacity	**1 to 25 kW** (1,000 to 25,000 watts)	**> 25 to 100 kW**	**> 100 kW to 200 kW**	**> 200 kW to 500 kW**
Base Incentive ($/watt dc)	$3.25	$2.50	$2.00	$1.50
PLUS: Additions to Base				
MA-Manufactured Components	$0.25	$0.25	$0.25	$0.25
Public Building Adder	$0.50	$0.50	$0.25	$0.25

Non-Residential: Commonwealth Solar Rebate Calculator	
Total PV Project Size (watts dc)	3135
Total PV Project Size for Rebate Calculation (500 kW cap)	**3,135**
MA-manufactured components	YES
Public Building Adder	YES
Rebate ($)	**$ 12,540.00**
Rebate ($/watt dc) based on total project size	**$ 4.00000**
Key	
Entry Cells	
Calculation Cells (not for Entry)	

Click here for Financial Model

DATA ENTRY AND FINANCIAL SUMMARY

Key

Entry Cells	
Cells Draw Data from Another Worksheet	
Calculation Cells (Not for Entry)	

Select Taxable or Non-Taxable Entity	Non-Taxable	
Project and Customer Cost Assumptions		
Solar Photovoltaic System Size	3,135	Watts (DC STC)
Total System Cost/Watt	$ 7.00	$/Watt (DC STC)
Total System Cost	$ 21,945	
MTC Rebate Assumptions		
MTC Scenario A: Non-Taxable Rebate	$ 4.000	$/Watt (DC STC)
Scenario A Rebate	$ 12,540	
MTC Scenario B: Taxable Rebate	$ 5.180	$/Watt (DC STC)
Scenario B Rebate	$ 16,239	
Project Performance and Savings/ Cost Assumptions		
Annual Net Capacity Factor	13.0%	kW (DC STC) to kWh AC
Annual Production Degradation	0.50%	%
Project Life	25	Years
Electricity Revenue (Avoided Costs)	$ 0.15	$/kWh
Electricity Revenue (Avoided Costs) Annual Adjustor	5.0%	%
Renewable Energy Certificate (REC) Revenue	$ 0.03	$/kWh
REC Revenue Annual Adjustor	0.0%	%
REC Revenue Term	3	Years (must be equal to or less than project life)
Annual Operations and Maintenance Cost	$ 250	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.75	$/Watt (DC STC)
Inverter Life, Replace Every X Years	15	Year (must be equal to or less than project life)

Scenario Definitions

Scenario A: Non-Taxable Rebate - Assumes that the state rebate is non-taxable, but is subtracted from the cost basis for purposes of

Scenario B: Taxable Rebate - Assumes that the state rebate is taxable, but is not subtracted from the cost basis for purposes of deter

Both Scenarios assume that the project owner can use both federal and state tax benefits

Tax Assumptions

Federal Tax Rate	0%					
State Tax Rate	0%					
Effective Tax Rate	0%					
Federal Tax Credit	0%					
State Tax Deduction	0%					
5 Year Accelerated Depreciation Schedule (MACRS)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Financing Assumptions

% Financed w/ Cash	100%	
% Financed w/ Loan	0%	
Loan Interest Rate	8%	
Loan Period	20	Years (must be equal to or less than project life)
Scenario A Net Cost	$ 9,405	
Scenario A Loan	$ -	
Scenario B Net Cost	$ 5,706	
Scenario B Loan	$ -	
Customer Discount Rate	6%	

Solar Project Financial Analysis Summary	
Scenario A: Net Present Value	**$ (3,697)**
Scenario A: Simple Payback (100% Cash only)	**Year 22**
Scenario A: Estimated Return on Equity	**#DIV/0!**
Scenario A: Guess Return on Equity	50%
Scenario B: Net Present Value	**$ 2**
Scenario B: Simple Payback (100% Cash only)	**Year 14**
Scenario B: Estimated Return on Equity	**#DIV/0!**
Scenario B: Guess Return on Equity	50%

PRO FORMA AND PRODUCTION

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Annual Generation (kWh)		3,570	3,552	3,535	3,517	3,499	3,482

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 536	$ 559	$ 585	$ 611	$ 638	$ 667
REC Revenue		$ 107	$ 107	$ 106	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 643	$ 666	$ 691	$ 611	$ 638	$ 667
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 393	$ 409	$ 425	$ 337	$ 357	$ 377
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 393	$ 409	$ 425	$ 337	$ 357	$ 377
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 393	$ 409	$ 425	$ 337	$ 357	$ 377
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Net Income		**$ 393**	**$ 409**	**$ 425**	**$ 337**	**$ 357**	**$ 377**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 393	$ 409	$ 425	$ 337	$ 357	$ 377
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 393	$ 409	$ 425	$ 337	$ 357	$ 377
Cash From Investing							
Installed PV Cost	$ (9,405)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (9,405)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ (9,405)**	**$ 393**	**$ 409**	**$ 425**	**$ 337**	**$ 357**	**$ 377**
Cumulative Cash Flow	**$ (9,405)**	**$ (9,012)**	**$ (8,604)**	**$ (8,178)**	**$ (7,841)**	**$ (7,484)**	**$ (7,108)**

PRO FORMA AND PRODUCTION

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Annual Generation (kWh)	3,464	3,447	3,430	3,413	3,396	3,379	3,362

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 696	$ 728	$ 760	$ 794	$ 830	$ 867	$ 906
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 696	$ 728	$ 760	$ 794	$ 830	$ 867	$ 906
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 398	$ 420	$ 443	$ 468	$ 494	$ 521	$ 549
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 398	$ 420	$ 443	$ 468	$ 494	$ 521	$ 549
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 398	$ 420	$ 443	$ 468	$ 494	$ 521	$ 549
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 398**	**$ 420**	**$ 443**	**$ 468**	**$ 494**	**$ 521**	**$ 549**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 398	$ 420	$ 443	$ 468	$ 494	$ 521	$ 549
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 398	$ 420	$ 443	$ 468	$ 494	$ 521	$ 549
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 398**	**$ 420**	**$ 443**	**$ 468**	**$ 494**	**$ 521**	**$ 549**
Cumulative Cash Flow	**$ (6,710)**	**$ (6,290)**	**$ (5,846)**	**$ (5,378)**	**$ (4,885)**	**$ (4,364)**	**$ (3,815)**

PRO FORMA AND PRODUCTION

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Annual Generation (kWh)	3,345	3,328	3,312	$ 3,295	3,279	3,262	3,246

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 946	$ 988	$ 1,033	$ 1,079	$ 1,127	$ 1,178	$ 1,230
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 946	$ 988	$ 1,033	$ 1,079	$ 1,127	$ 1,178	$ 1,230
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (2,351)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (2,729)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 579	$ (1,741)	$ 643	$ 678	$ 714	$ 752	$ 792
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 579	$ (1,741)	$ 643	$ 678	$ 714	$ 752	$ 792
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 579	$ (1,741)	$ 643	$ 678	$ 714	$ 752	$ 792
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 579**	**$ (1,741)**	**$ 643**	**$ 678**	**$ 714**	**$ 752**	**$ 792**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 579	$ (1,741)	$ 643	$ 678	$ 714	$ 752	$ 792
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 579	$ (1,741)	$ 643	$ 678	$ 714	$ 752	$ 792
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 579**	**$ (1,741)**	**$ 643**	**$ 678**	**$ 714**	**$ 752**	**$ 792**
Cumulative Cash Flow	**$ (3,236)**	**$ (4,977)**	**$ (4,334)**	**$ (3,656)**	**$ (2,942)**	**$ (2,190)**	**$ (1,398)**

PRO FORMA AND PRODUCTION

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Annual Generation (kWh)	3,230	3,213	3,197	3,181	3,165

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 21	Year 22	Year 23	Year 24	Year 25
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 1,285	$ 1,343	$ 1,403	$ 1,466	$ 1,531
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,285	$ 1,343	$ 1,403	$ 1,466	$ 1,531
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 834	$ 878	$ 924	$ 972	$ 1,023
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 834	$ 878	$ 924	$ 972	$ 1,023
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 834	$ 878	$ 924	$ 972	$ 1,023
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 834**	**$ 878**	**$ 924**	**$ 972**	**$ 1,023**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 834	$ 878	$ 924	$ 972	$ 1,023
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 834	$ 878	$ 924	$ 972	$ 1,023
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 834**	**$ 878**	**$ 924**	**$ 972**	**$ 1,023**
Cumulative Cash Flow	**$ (564)**	**$ 314**	**$ 1,238**	**$ 2,210**	**$ 3,233**

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 536	$ 559	$ 585	$ 611	$ 638	$ 667
REC Revenue		$ 107	$ 107	$ 106	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 643	$ 666	$ 691	$ 611	$ 638	$ 667
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 393	$ 409	$ 425	$ 337	$ 357	$ 377
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 393	$ 409	$ 425	$ 337	$ 357	$ 377
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 393	$ 409	$ 425	$ 337	$ 357	$ 377
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate		$ -					
Net Income		**$ 393**	**$ 409**	**$ 425**	**$ 337**	**$ 357**	**$ 377**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 393	$ 409	$ 425	$ 337	$ 357	$ 377
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 393	$ 409	$ 425	$ 337	$ 357	$ 377
Cash From Investing							
Installed PV Cost	$ (5,706)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (5,706)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ (5,706)**	**$ 393**	**$ 409**	**$ 425**	**$ 337**	**$ 357**	**$ 377**
Cumulative Cash Flow	**$ (5,706)**	**$ (5,313)**	**$ (4,905)**	**$ (4,479)**	**$ (4,142)**	**$ (3,785)**	**$ (3,408)**

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 696	$ 728	$ 760	$ 794	$ 830	$ 867	$ 906
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 696	$ 728	$ 760	$ 794	$ 830	$ 867	$ 906
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 398	$ 420	$ 443	$ 468	$ 494	$ 521	$ 549
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 398	$ 420	$ 443	$ 468	$ 494	$ 521	$ 549
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 398	$ 420	$ 443	$ 468	$ 494	$ 521	$ 549
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 398**	**$ 420**	**$ 443**	**$ 468**	**$ 494**	**$ 521**	**$ 549**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 398	$ 420	$ 443	$ 468	$ 494	$ 521	$ 549
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 398	$ 420	$ 443	$ 468	$ 494	$ 521	$ 549
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 398**	**$ 420**	**$ 443**	**$ 468**	**$ 494**	**$ 521**	**$ 549**
Cumulative Cash Flow	**$ (3,010)**	**$ (2,590)**	**$ (2,147)**	**$ (1,679)**	**$ (1,185)**	**$ (665)**	**$ (115)**

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 946	$ 988	$ 1,033	$ 1,079	$ 1,127	$ 1,178	$ 1,230
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 946	$ 988	$ 1,033	$ 1,079	$ 1,127	$ 1,178	$ 1,230
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (2,351)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (2,729)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 579	$ (1,741)	$ 643	$ 678	$ 714	$ 752	$ 792
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 579	$ (1,741)	$ 643	$ 678	$ 714	$ 752	$ 792
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 579	$ (1,741)	$ 643	$ 678	$ 714	$ 752	$ 792
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 579**	**$ (1,741)**	**$ 643**	**$ 678**	**$ 714**	**$ 752**	**$ 792**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 579	$ (1,741)	$ 643	$ 678	$ 714	$ 752	$ 792
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 579	$ (1,741)	$ 643	$ 678	$ 714	$ 752	$ 792
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 579**	**$ (1,741)**	**$ 643**	**$ 678**	**$ 714**	**$ 752**	**$ 792**
Cumulative Cash Flow	**$ 463**	**$ (1,277)**	**$ (634)**	**$ 43**	**$ 757**	**$ 1,509**	**$ 2,301**

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Scenario B: Taxable Rebate; Pro Forma Project Economics					
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 1,285	$ 1,343	$ 1,403	$ 1,466	$ 1,531
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,285	$ 1,343	$ 1,403	$ 1,466	$ 1,531
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 834	$ 878	$ 924	$ 972	$ 1,023
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 834	$ 878	$ 924	$ 972	$ 1,023
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 834	$ 878	$ 924	$ 972	$ 1,023
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate					
Net Income	**$ 834**	**$ 878**	**$ 924**	**$ 972**	**$ 1,023**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 834	$ 878	$ 924	$ 972	$ 1,023
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 834	$ 878	$ 924	$ 972	$ 1,023
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 834**	**$ 878**	**$ 924**	**$ 972**	**$ 1,023**
Cumulative Cash Flow	**$ 3,135**	**$ 4,013**	**$ 4,937**	**$ 5,909**	**$ 6,932**

12 CHANNEL STREET

Table 72: 12 Channel St PV Profile

Building	
Building Name	Building Q
Building Address	12 Channel St Boston, MA
City Department	Boston Redevelopment Authority
Number of floors	9
Square footage (if known)	
Fuel Type(s)	Electricity / Natural Gas
Contact Information	
Facilities Manager	Dolores Fazio
Phone	(617) 918-6209
Email	Dolores.Fazio.BRA@CityOfBoston.gov
Electrical Connection	
Electric Utility Company	
Floor Plan showing Electrical room	Yes / No
Roof Details	
Roof slope/angle (Flat = 0°)	0°
Roof Orientation (S, SE, SW, etc.)	N/A
Roof Size – Square Feet	
Roof Condition: poor, fair, good, excellent, new	Good
Roof Type (asphalt, shingles, rubber membrane, etc.)	Rubber
Expected life of roof (years)	
Equipment/obstructions on the roof	Covered Stairwells / Storage
Detailed Roof Drawings available	Yes / No

Table 73: 12 Channel St Summary of Findings

Summary of Findings	
Suited for Solar Water Heating?	No
Shading on Roof (%)	0.94%
Area of roof available for panel installation	
Number of panels installed for assessment	100
DC Output of number of panels for assessment	19,500 W
Net Capacity Factor (%)	13.2%
Cost of Installation:	$9,534

Figure 56: 12 Channel Street Solar Pathfinder Report

Site Report

Report Name	12 Channel St
Report Date	3/25/2008 10:30:10 AM
Declination	-15d 13m
Location	BOSTON, MA, Zipcode: 02210
Lat/Long	42.348 / -71.041
Weather Station	Boston, MA, Elevation: 6 m
Site distance	1.34 miles
Array Type	Fixed
Tilt Angle	42.35 deg
Ideal Tilt Angle	43.00 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Count	100
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	Custom
Layout Point Count	3

Notes: [None]
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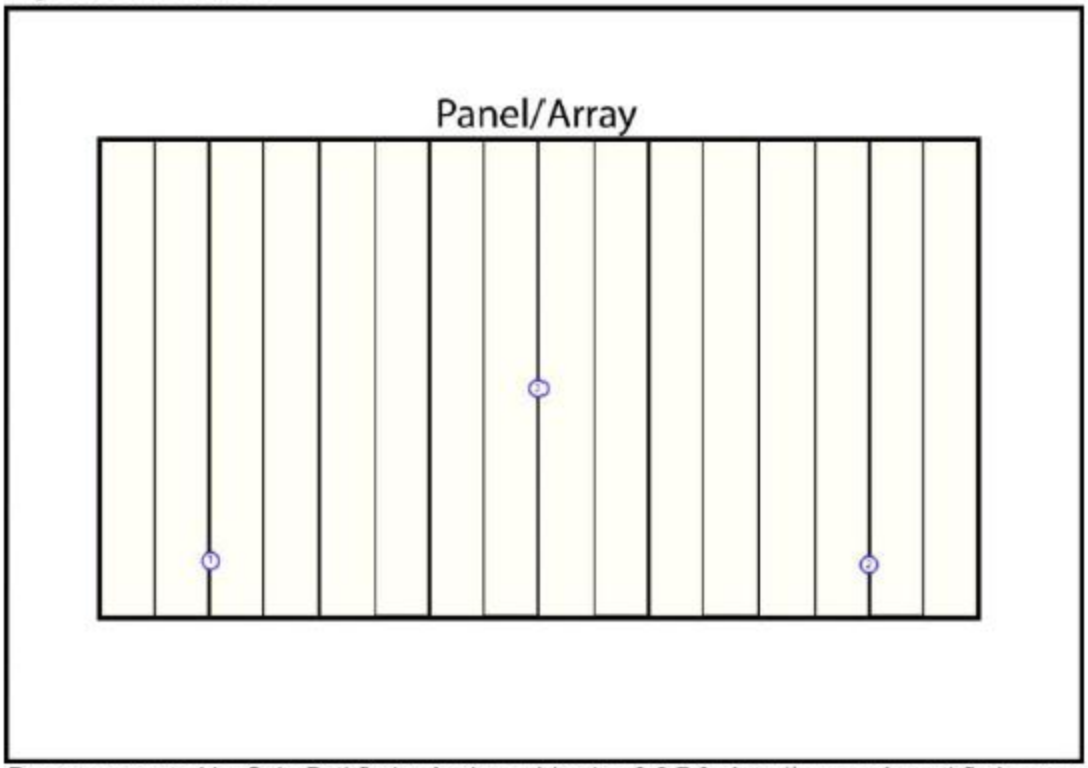
System Picture Layout

Layout Type Custom
Layout Point Count 3



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Solar Site Analysis Report

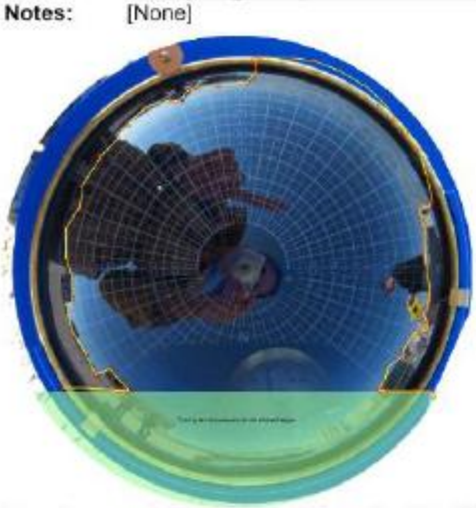
1

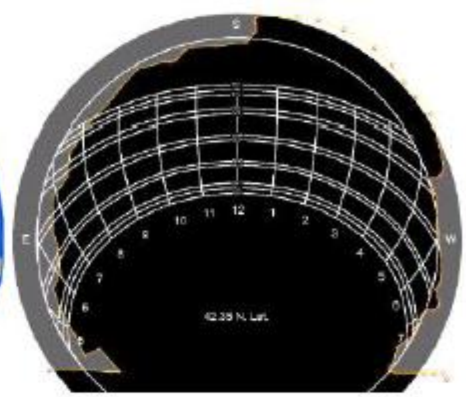
Image File Marine Industrial Park 12 Chanel St 3-24 008.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	99.00%	2.47	1242.00	1240.77
February	99.00%	3.29	1465.00	1459.61
March	99.00%	4.17	2041.00	2036.84
April	99.00%	4.47	2032.00	2022.66
May	100.00%	5.09	2316.00	2315.40
June	100.00%	5.71	2426.00	2425.62
July	100.00%	5.36	2337.00	2336.81
August	99.00%	5.02	2225.00	2216.01
September	99.00%	5.10	2258.00	2240.76
October	98.00%	3.79	1775.00	1750.03
November	98.00%	2.70	1272.00	1257.02
December	98.00%	2.29	1164.00	1146.46
Totals	**99.06%**	**49.45**	**22553.0**	**22447.99**
	Unweighted Yearly Avg	**Effect: 99.22% Sun Hrs: 4.12**		

Notes: [None]





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Solar Site Analysis Report

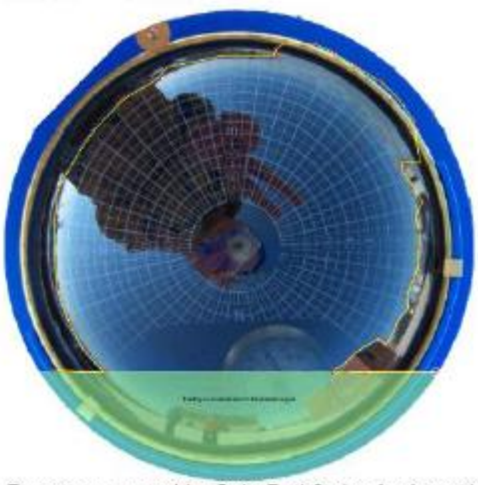
2

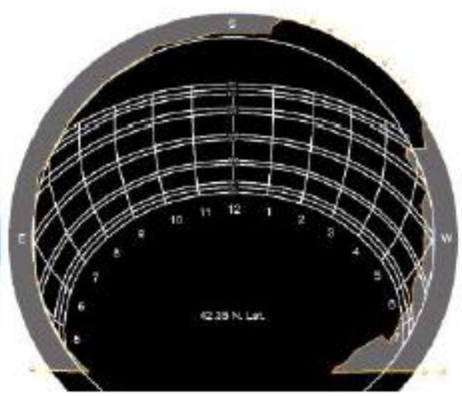
Image File Marine Industrial Park 12 Chanel St 3-24 009.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	100.00%	2.48	1242.00	1242.00
February	100.00%	3.31	1465.00	1465.00
March	100.00%	4.19	2041.00	2040.53
April	100.00%	4.49	2032.00	2032.00
May	100.00%	5.10	2316.00	2315.70
June	100.00%	5.70	2426.00	2425.40
July	100.00%	5.36	2337.00	2336.75
August	100.00%	5.05	2225.00	2225.00
September	100.00%	5.14	2258.00	2257.73
October	100.00%	3.85	1775.00	1775.00
November	99.00%	2.73	1272.00	1270.31
December	100.00%	2.33	1164.00	1164.00
Totals	**99.73%**	**49.73**	**22553.0**	**22549.43**
	Unweighted Yearly Avg	**Effect: 99.79% Sun Hrs: 4.14**		

Notes: [None]





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Solar Site Analysis Report

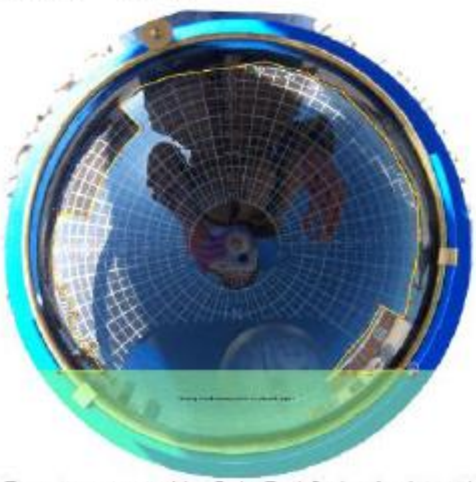
3

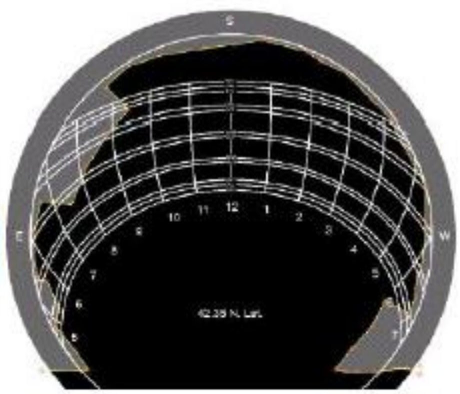
Image File Marine Industrial Park 12 Chanel St 3-24 013.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	93.00%	2.33	1242.00	1182.31
February	94.00%	3.11	1465.00	1389.00
March	96.00%	4.02	2041.00	1958.40
April	100.00%	4.49	2032.00	2032.00
May	100.00%	5.08	2316.00	2314.95
June	100.00%	5.68	2426.00	2424.80
July	100.00%	5.35	2337.00	2336.56
August	100.00%	5.04	2225.00	2225.00
September	96.00%	4.95	2258.00	2173.02
October	90.00%	3.50	1775.00	1614.18
November	85.00%	2.35	1272.00	1101.14
December	92.00%	2.15	1164.00	1081.96
Totals	**95.42%**	**48.05**	**22553.0**	**21833.32**
	Unweighted Yearly Avg	**Effect: 96.41% Sun Hrs: 4.00**		

Notes: [None]





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Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	97.33%	2.43	1242.00	1221.69
February	97.67%	3.24	1465.00	1437.87
March	98.33%	4.13	2041.00	2011.92
April	99.67%	4.48	2032.00	2028.89
May	100.00%	5.09	2316.00	2315.35
June	100.00%	5.70	2426.00	2425.27
July	100.00%	5.36	2337.00	2336.71
August	99.67%	5.04	2225.00	2222.00
September	98.33%	5.06	2258.00	2223.84
October	96.00%	3.71	1775.00	1713.07
November	94.00%	2.59	1272.00	1209.49
December	96.67%	2.26	1164.00	1130.81
Totals	**98.14%**	**49.45**	**22553.0**	**22276.91**
	Unweighted	**Effect: 98.47%**		
	Yearly Avg	**Sun Hrs: 4.09**		

Notes: [None]

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Table 74: 12 Channel St MTC Rebate Estimator Summary

Commonwealth Solar Non-Residential Solar Photovoltaic Calculator

Non-Residential: Commonwealth Solar Rebate Matrix ($/watt dc)

Incremental Capacity	1 to 25 kW (1,000 to 25,000 watts)	> 25 to 100 kW	> 100 kW to 200 kW	> 200 kW to 500 kW
Base Incentive ($/watt dc)	$3.25	$2.50	$2.00	$1.50
PLUS: Additions to Base				
MA-Manufactured Components	$0.25	$0.25	$0.25	$0.25
Public Building Adder	$0.50	$0.50	$0.25	$0.25

Non-Residential: Commonwealth Solar Rebate Calculator

Total PV Project Size (watts dc)	3178
Total PV Project Size for Rebate Calculation (500 kW cap)	**3,178**
MA-manufactured components	YES
Public Building Adder	YES
Rebate ($)	**$ 12,712.00**
Rebate ($/watt dc) based on total project size	**$ 4.00000**

Click here for Financial Model

Key	
Entry Cells	
Calculation Cells (not for Entry)	

DATA ENTRY AND FINANCIAL SUMMARY

Key

Entry Cells	
Cells Draw Data from Another Worksheet	
Calculation Cells (Not for Entry)	

Select Taxable or Non-Taxable Entity	Non-Taxable	
Project and Customer Cost Assumptions		
Solar Photovoltaic System Size	3,178	Watts (DC STC)
Total System Cost/Watt	$ 7.00	$/Watt (DC STC)
Total System Cost	$ 22,246	
MTC Rebate Assumptions		
MTC Scenario A: Non-Taxable Rebate	$ 4.000	$/Watt (DC STC)
Scenario A Rebate	$ 12,712	
MTC Scenario B: Taxable Rebate	$ 5.161	$/Watt (DC STC)
Scenario B Rebate	$ 16,402	
Project Performance and Savings/ Cost Assumptions		
Annual Net Capacity Factor	13.0%	kW (DC STC) to kWh AC
Annual Production Degradation	0.50%	%
Project Life	25	Years
Electricity Revenue (Avoided Costs)	$ 0.15	$/kWh
Electricity Revenue (Avoided Costs) Annual Adjustor	5.0%	%
Renewable Energy Certificate (REC) Revenue	$ 0.03	$/kWh
REC Revenue Annual Adjustor	0.0%	%
REC Revenue Term	3	Years (must be equal to or less than project life)
Annual Operations and Maintenance Cost	$ 250	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.75	$/Watt (DC STC)
Inverter Life, Replace Every X Years	15	Year (must be equal to or less than project life)

Scenario Definitions

Scenario A: Non-Taxable Rebate - Assumes that the state rebate is non-taxable, but is subtracted from the cost basis for purposes of

Scenario B: Taxable Rebate - Assumes that the state rebate is taxable, but is not subtracted from the cost basis for purposes of deter

Both Scenarios assume that the project owner can use both federal and state tax benefits

Tax Assumptions

Federal Tax Rate	0%					
State Tax Rate	0%					
Effective Tax Rate	0%					
Federal Tax Credit	0%					
State Tax Deduction	0%					
5 Year Accelerated Depreciation Schedule (MACRS)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Financing Assumptions

% Financed w/ Cash	100%	
% Financed w/ Loan	0%	
Loan Interest Rate	8%	
Loan Period	20	Years (must be equal to or less than project life)
Scenario A Net Cost	$ 9,534	
Scenario A Loan	$ -	
Scenario B Net Cost	$ 5,844	
Scenario B Loan	$ -	
Customer Discount Rate	6%	

Solar Project Financial Analysis Summary	
Scenario A: Net Present Value	**$ (3,689)**
Scenario A: Simple Payback (100% Cash only)	**Year 22**
Scenario A: Estimated Return on Equity	**#DIV/0!**
Scenario A: Guess Return on Equity	50%
Scenario B: Net Present Value	**$ 1**
Scenario B: Simple Payback (100% Cash only)	**Year 14**
Scenario B: Estimated Return on Equity	**#DIV/0!**
Scenario B: Guess Return on Equity	50%

PRO FORMA AND PRODUCTION

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Annual Generation (kWh)		3,619	3,601	3,583	3,565	3,547	3,530

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 543	$ 567	$ 593	$ 619	$ 647	$ 676
REC Revenue		$ 109	$ 108	$ 107	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 651	$ 675	$ 700	$ 619	$ 647	$ 676
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Net Income		**$ 401**	**$ 418**	**$ 435**	**$ 346**	**$ 365**	**$ 386**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Cash From Investing							
Installed PV Cost	$ (9,534)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (9,534)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ (9,534)**	**$ 401**	**$ 418**	**$ 435**	**$ 346**	**$ 365**	**$ 386**
Cumulative Cash Flow	**$ (9,534)**	**$ (9,133)**	**$ (8,715)**	**$ (8,280)**	**$ (7,934)**	**$ (7,569)**	**$ (7,183)**

PRO FORMA AND PRODUCTION

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Annual Generation (kWh)	3,512	3,494	3,477	3,459	3,442	3,425	3,408

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 706	$ 738	$ 771	$ 805	$ 841	$ 879	$ 918
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 706	$ 738	$ 771	$ 805	$ 841	$ 879	$ 918
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 407**	**$ 430**	**$ 454**	**$ 479**	**$ 505**	**$ 533**	**$ 562**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 407**	**$ 430**	**$ 454**	**$ 479**	**$ 505**	**$ 533**	**$ 562**
Cumulative Cash Flow	**$ (6,776)**	**$ (6,345)**	**$ (5,892)**	**$ (5,413)**	**$ (4,908)**	**$ (4,375)**	**$ (3,814)**

PRO FORMA AND PRODUCTION

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Annual Generation (kWh)	3,391	3,374	3,357	$ 3,340	3,323	3,307	3,290

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 959	$ 1,002	$ 1,047	$ 1,094	$ 1,143	$ 1,194	$ 1,247
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 959	$ 1,002	$ 1,047	$ 1,094	$ 1,143	$ 1,194	$ 1,247
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (2,384)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (2,762)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 592**	**$ (1,760)**	**$ 657**	**$ 693**	**$ 729**	**$ 768**	**$ 809**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 592**	**$ (1,760)**	**$ 657**	**$ 693**	**$ 729**	**$ 768**	**$ 809**
Cumulative Cash Flow	**$ (3,222)**	**$ (4,981)**	**$ (4,324)**	**$ (3,631)**	**$ (2,902)**	**$ (2,134)**	**$ (1,325)**

PRO FORMA AND PRODUCTION

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Annual Generation (kWh)	3,274	3,258	3,241	3,225	3,209

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 21	Year 22	Year 23	Year 24	Year 25
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 1,303	$ 1,361	$ 1,422	$ 1,486	$ 1,552
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,303	$ 1,361	$ 1,422	$ 1,486	$ 1,552
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 851	$ 896	$ 943	$ 992	$ 1,044
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 851	$ 896	$ 943	$ 992	$ 1,044
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 851	$ 896	$ 943	$ 992	$ 1,044
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 851**	**$ 896**	**$ 943**	**$ 992**	**$ 1,044**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 851	$ 896	$ 943	$ 992	$ 1,044
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 851	$ 896	$ 943	$ 992	$ 1,044
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 851**	**$ 896**	**$ 943**	**$ 992**	**$ 1,044**
Cumulative Cash Flow	**$ (474)**	**$ 423**	**$ 1,366**	**$ 2,358**	**$ 3,402**

	Start-Up	Year	Year	Year	Year	Year	Year
Project Output	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Annual Generation (kWh)		3,619	3,601	3,583	3,565	3,547	3,530
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 543	$ 567	$ 593	$ 619	$ 647	$ 676
REC Revenue		$ 109	$ 108	$ 107	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 651	$ 675	$ 700	$ 619	$ 647	$ 676
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate		$ -					
Net Income		**$ 401**	**$ 418**	**$ 435**	**$ 346**	**$ 365**	**$ 386**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 401	$ 418	$ 435	$ 346	$ 365	$ 386
Cash From Investing							
Installed PV Cost	$ (5,844)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (5,844)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ (5,844)**	**$ 401**	**$ 418**	**$ 435**	**$ 346**	**$ 365**	**$ 386**
Cumulative Cash Flow	**$ (5,844)**	**$ (5,443)**	**$ (5,025)**	**$ (4,590)**	**$ (4,245)**	**$ (3,879)**	**$ (3,493)**

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Annual Generation (kWh)	3,512	3,494	3,477	3,459	3,442	3,425	3,408
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 706	$ 738	$ 771	$ 805	$ 841	$ 879	$ 918
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 706	$ 738	$ 771	$ 805	$ 841	$ 879	$ 918
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 407**	**$ 430**	**$ 454**	**$ 479**	**$ 505**	**$ 533**	**$ 562**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 407	$ 430	$ 454	$ 479	$ 505	$ 533	$ 562
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 407**	**$ 430**	**$ 454**	**$ 479**	**$ 505**	**$ 533**	**$ 562**
Cumulative Cash Flow	**$ (3,086)**	**$ (2,656)**	**$ (2,202)**	**$ (1,723)**	**$ (1,218)**	**$ (685)**	**$ (124)**

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Annual Generation (kWh)	3,391	3,374	3,357	$ 3,340	3,323	3,307	3,290
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 959	$ 1,002	$ 1,047	$ 1,094	$ 1,143	$ 1,194	$ 1,247
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 959	$ 1,002	$ 1,047	$ 1,094	$ 1,143	$ 1,194	$ 1,247
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (2,384)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (2,762)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 592**	**$ (1,760)**	**$ 657**	**$ 693**	**$ 729**	**$ 768**	**$ 809**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 592	$ (1,760)	$ 657	$ 693	$ 729	$ 768	$ 809
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 592**	**$ (1,760)**	**$ 657**	**$ 693**	**$ 729**	**$ 768**	**$ 809**
Cumulative Cash Flow	**$ 468**	**$ (1,292)**	**$ (634)**	**$ 58**	**$ 788**	**$ 1,556**	**$ 2,365**

Project Output	**Year 21**	**Year 22**	**Year 23**	**Year 24**	**Year 25**
Annual Generation (kWh)	3,274	3,258	3,241	3,225	3,209
Scenario B: Taxable Rebate; Pro Forma Project Economics					
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 1,303	$ 1,361	$ 1,422	$ 1,486	$ 1,552
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,303	$ 1,361	$ 1,422	$ 1,486	$ 1,552
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 851	$ 896	$ 943	$ 992	$ 1,044
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 851	$ 896	$ 943	$ 992	$ 1,044
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 851	$ 896	$ 943	$ 992	$ 1,044
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate					
Net Income	**$ 851**	**$ 896**	**$ 943**	**$ 992**	**$ 1,044**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 851	$ 896	$ 943	$ 992	$ 1,044
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 851	$ 896	$ 943	$ 992	$ 1,044
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 851**	**$ 896**	**$ 943**	**$ 992**	**$ 1,044**
Cumulative Cash Flow	**$ 3,216**	**$ 4,112**	**$ 5,055**	**$ 6,048**	**$ 7,092**

BOSTON DESIGN CENTER

Table 75: Boston Design Center PV Profile

Building	
Building Name	Boston Design Center
Building Address	1 Design Center Place Boston, MA
City Department	N/A – Private Building
Number of floors	9
Square footage (if known)	
Fuel Type(s)	Electricity / Natural Gas
Contact Information	
Facilities Manager	Stephen Iacovino
Phone	siacovino@mmart.com
Email	(617) 449-5507
Electrical Connection	
Electric Utility Company	NStar
Floor Plan showing Electrical room	Yes / No
Roof Details	
Roof slope/angle (Flat = 0°)	0°
Roof Orientation (S, SE, SW, etc.)	N/A
Roof Size – Square Feet	
Roof Condition: poor, fair, good, excellent, new	Good
Roof Type (asphalt, shingles, rubber membrane, etc.)	Rubber
Expected life of roof (years)	
Equipment/obstructions on the roof	HVAC / Storage
Detailed Roof Drawings available	Yes / No

Table 76: Boston Design Center Summary of Findings

Summary of Findings	
Suited for Solar Water Heating?	No
Shading on Roof (%)	0.5%
Area of roof available for panel installation	
Number of panels installed for assessment	100
DC Output of number of panels in assessment	19,500 W
Net Capacity Factor (%)	13.2%
Cost of Installation:	$9.624

Figure 57: Boston Design Center Solar Pathfinder Report

Site Report

Report Name	1 Design Center
Report Date	3/25/2008 10:55:13 AM
Declination	-15d 13m
Location	BOSTON, MA, Zipcode: 02210
Lat/Long	42.348 / -71.041
Weather Station	Boston, MA, Elevation: 6 m
Site distance	1.34 miles
Array Type	Fixed
Tilt Angle	42.35 deg
Ideal Tilt Angle	43.00 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Count	100
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	Custom
Layout Point Count	2

Notes: [None]
Report generated by SolarPathfinder Assistant Version 3.0.7.0. http://www.solarpathfinder.com
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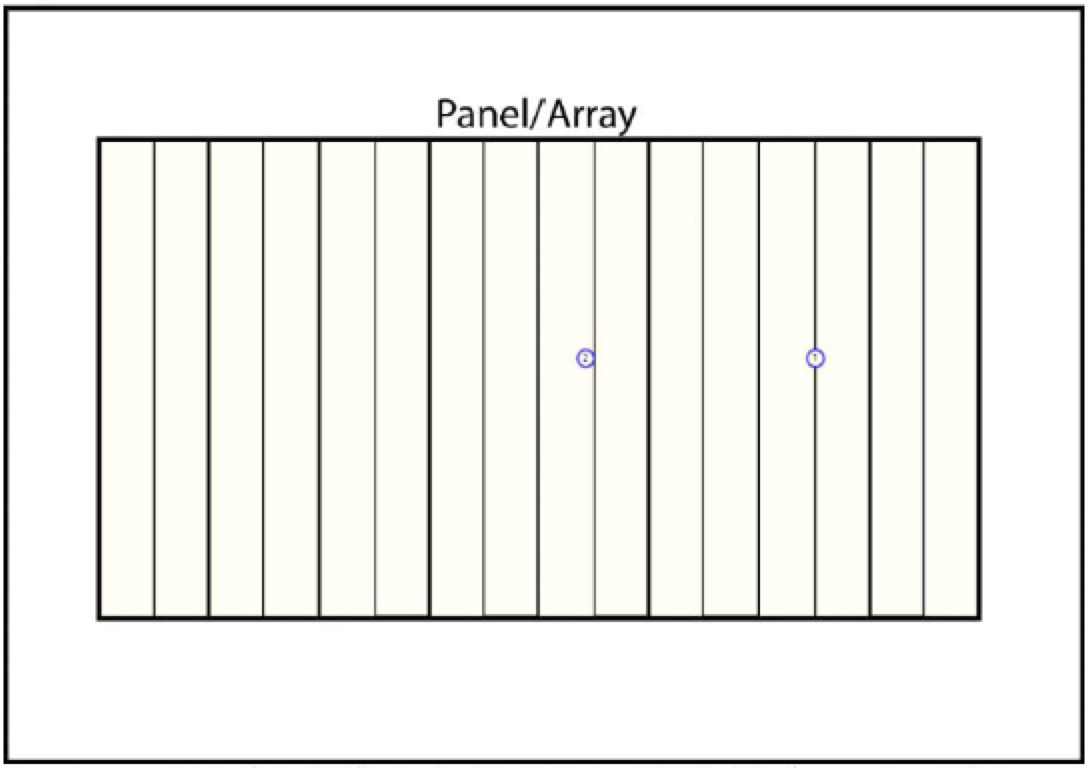
System Picture Layout

Layout Type Custom
Layout Point Count 2



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Solar Site Analysis Report

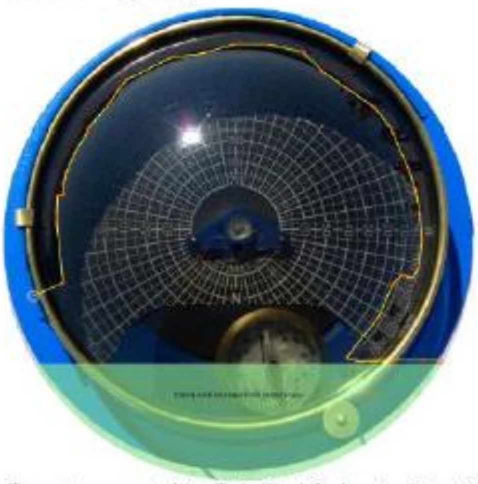
1

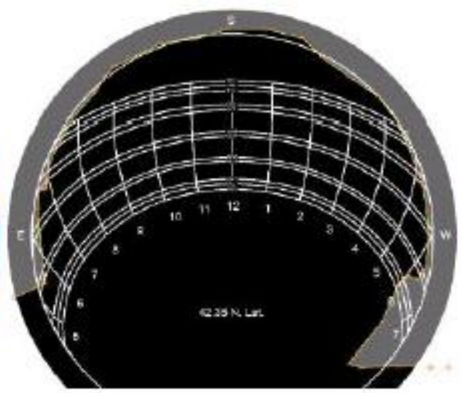
Image File Marine Industrial Park 1 Design Center Rd 3-24 020.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	99.00%	2.48	1242.00	1242.00
February	99.00%	3.31	1465.00	1464.51
March	100.00%	4.18	2041.00	2039.37
April	100.00%	4.49	2032.00	2032.00
May	100.00%	5.08	2316.00	2315.05
June	99.00%	5.66	2426.00	2423.30
July	100.00%	5.34	2337.00	2336.05
August	100.00%	5.05	2225.00	2225.00
September	99.00%	5.12	2258.00	2251.11
October	100.00%	3.85	1775.00	1775.00
November	99.00%	2.72	1272.00	1265.97
December	99.00%	2.33	1164.00	1164.00
Totals	**99.50%**	**49.61**	**22553.0**	**22533.37**
	Unweighted Yearly Avg	**Effect: 99.54% Sun Hrs: 4.13**		

Notes: [None]





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Solar Site Analysis Report

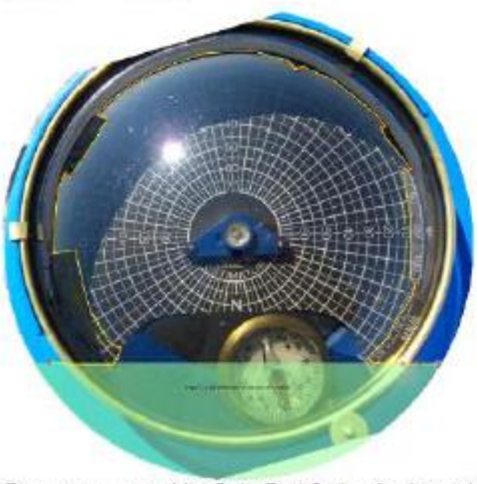
2

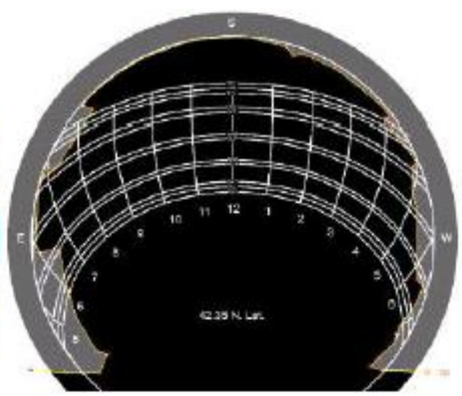
Image File Marine Industrial Park 1 Design Center Rd 3-24 023.jpg

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	98.00%	2.45	1242.00	1235.80
February	99.00%	3.29	1465.00	1457.77
March	99.00%	4.18	2041.00	2039.84
April	99.00%	4.45	2032.00	2021.18
May	99.00%	5.03	2316.00	2301.57
June	99.00%	5.65	2426.00	2422.06
July	99.00%	5.32	2337.00	2332.40
August	98.00%	4.97	2225.00	2205.61
September	99.00%	5.12	2258.00	2255.18
October	99.00%	3.83	1775.00	1771.77
November	97.00%	2.68	1272.00	1252.82
December	97.00%	2.28	1164.00	1146.46
Totals	**98.68%**	**49.25**	**22553.0**	**22442.46**
	Unweighted Yearly Avg	**Effect: 98.83% Sun Hrs: 4.10**		

Notes: [None]





Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.35	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.35 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.3	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.3
January	98.50%	2.47	1242.00	1238.90
February	99.00%	3.30	1465.00	1461.14
March	99.50%	4.18	2041.00	2039.61
April	99.50%	4.47	2032.00	2026.59
May	99.50%	5.06	2316.00	2308.31
June	99.00%	5.66	2426.00	2422.68
July	99.50%	5.33	2337.00	2334.23
August	99.00%	5.01	2225.00	2215.31
September	99.00%	5.12	2258.00	2253.15
October	99.50%	3.84	1775.00	1773.39
November	98.00%	2.70	1272.00	1259.40
December	98.00%	2.31	1164.00	1155.23
Totals	**99.00%**	**49.61**	**22553.0**	**22487.91**
	Unweighted	**Effect: 99.19%**		
	Yearly Avg	**Sun Hrs: 4.12**		

Notes: [None]

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Table 77: Boston Design Center MTC Rebate Estimator Summary

Commonwealth Solar Non-Residential Solar Photovoltaic Calculator

Non-Residential: Commonwealth Solar Rebate Matrix ($/watt dc)				
Incremental Capacity	**1 to 25 kW** (1,000 to 25,000 watts)	**> 25 to 100 kW**	**> 100 kW to 200 kW**	**> 200 kW to 500 kW**
Base Incentive ($/watt dc)	$3.25	$2.50	$2.00	$1.50
PLUS: Additions to Base				
MA-Manufactured Components	$0.25	$0.25	$0.25	$0.25
Public Building Adder	$0.50	$0.50	$0.25	$0.25

Non-Residential: Commonwealth Solar Rebate Calculator

Total PV Project Size (watts dc)	3208	Click here for Financial Model
Total PV Project Size for Rebate Calculation	**3,208**	
MA-manufactured components	YES	
Public Building Adder	YES	
Rebate ($)	**$ 12,832.00**	
Rebate ($/watt dc) based on total projec	**$ 4.00000**	

Key

Entry Cells	(green)
Calculation Cells (not for Entry)	(yellow)

DATA ENTRY AND FINANCIAL SUMMARY

Key		
Entry Cells		
Cells Draw Data from Another Worksheet		
Calculation Cells (Not for Entry)		
Select Taxable or Non-Taxable Entity	Non-Taxable	
Project and Customer Cost Assumptions		
Solar Photovoltaic System Size	3,208	Watts (DC STC)
Total System Cost/Watt	$ 7.00	$/Watt (DC STC)
Total System Cost	$ 22,456	
MTC Rebate Assumptions		
MTC Scenario A: Non-Taxable Rebate	$ 4.000	$/Watt (DC STC)
Scenario A Rebate	$ 12,832	
MTC Scenario B: Taxable Rebate	$ 5.149	$/Watt (DC STC)
Scenario B Rebate	$ 16,518	
Project Performance and Savings/ Cost Assumptions		
Annual Net Capacity Factor	13.0%	kW (DC STC) to kWh AC
Annual Production Degradation	0.50%	%
Project Life	25	Years
Electricity Revenue (Avoided Costs)	$ 0.15	$/kWh
Electricity Revenue (Avoided Costs) Annual Ad	5.0%	%
Renewable Energy Certificate (REC) Revenue	$ 0.03	$/kWh
REC Revenue Annual Adjustor	0.0%	%
REC Revenue Term	3	Years (must be equal to or less than project life)
Annual Operations and Maintenance Cost	$ 250	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.75	$/Watt (DC STC)
Inverter Life, Replace Every X Years	15	Year (must be equal to or less than project life)

Scenario Definitions							
Scenario A: Non-Taxable Rebate - Assumes that the state rebate is non-taxable, but is subtract							
Scenario B: Taxable Rebate - Assumes that the state rebate is taxable, but is not subtracted fro							
Both Scenarios assume that the project owner can use both federal and state tax benefits							
Tax Assumptions							
Federal Tax Rate	0%						
State Tax Rate	0%						
Effective Tax Rate	0%						
Federal Tax Credit	0%						
State Tax Deduction	0%						
5 Year Accelerated Depreciation S	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
Financing Assumptions							
% Financed w/ Cash	100%						
% Financed w/ Loan	0%						
Loan Interest Rate	8%						
Loan Period	20	Years (must be equal to or less than project life)					
Scenario A Net Cost	$ 9,624						
Scenario A Loan	$ -						
Scenario B Net Cost	$ 5,938						
Scenario B Loan	$ -						
Customer Discount Rate	6%						
Solar Project Financial Analysis Summary							
Scenario A: Net Present Value	**$ (3,684)**						
Scenario A: Simple Payback (100%	**Year 22**						
Scenario A: Estimated Return on E	**#DIV/0!**						
Scenario A: Guess Return on Equ	50%						
Scenario B: Net Present Value	**$ 2**						
Scenario B: Simple Payback (100%	**Year 14**						
Scenario B: Estimated Return on E	**#DIV/0!**						
Scenario B: Guess Return on Equ	50%						

PRO FORMA AND PRODUCTION

	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Project Output							
Annual Generation (kWh)		3,653	3,635	3,617	3,599	3,581	3,563

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 548	$ 573	$ 598	$ 625	$ 653	$ 682
REC Revenue		$ 110	$ 109	$ 109	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 658	$ 682	$ 707	$ 625	$ 653	$ 682
Replace Inverter?		No	No	No	No	No	No
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 408	$ 424	$ 441	$ 352	$ 371	$ 392
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 408	$ 424	$ 441	$ 352	$ 371	$ 392
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 408	$ 424	$ 441	$ 352	$ 371	$ 392
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense		$ -	$ -	$ -	$ -	$ -	$ -
Net Income		**$ 408**	**$ 424**	**$ 441**	**$ 352**	**$ 371**	**$ 392**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 408	$ 424	$ 441	$ 352	$ 371	$ 392
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 408	$ 424	$ 441	$ 352	$ 371	$ 392
Cash From Investing							
Installed PV Cost	$ (9,624)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (9,624)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ (9,624)**	**$ 408**	**$ 424**	**$ 441**	**$ 352**	**$ 371**	**$ 392**
Cumulative Cash Flow	**$ (9,624)**	**$ (9,216)**	**$ (8,792)**	**$ (8,351)**	**$ (7,999)**	**$ (7,628)**	**$ (7,235)**

PRO FORMA AND PRODUCTION

	Year	Year	Year	Year	Year	Year	Year
Project Output	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Annual Generation (kWh)	3,545	3,527	3,510	3,492	3,475	3,457	3,440

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 713	$ 744	$ 778	$ 813	$ 849	$ 887	$ 927
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 713	$ 744	$ 778	$ 813	$ 849	$ 887	$ 927
Replace Inverter?	No	No	No	No	No	No	No
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 414	$ 437	$ 461	$ 486	$ 513	$ 541	$ 570
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 414	$ 437	$ 461	$ 486	$ 513	$ 541	$ 570
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 414	$ 437	$ 461	$ 486	$ 513	$ 541	$ 570
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depre	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 414**	**$ 437**	**$ 461**	**$ 486**	**$ 513**	**$ 541**	**$ 570**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 414	$ 437	$ 461	$ 486	$ 513	$ 541	$ 570
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 414	$ 437	$ 461	$ 486	$ 513	$ 541	$ 570
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 414**	**$ 437**	**$ 461**	**$ 486**	**$ 513**	**$ 541**	**$ 570**
Cumulative Cash Flow	**$ (6,821)**	**$ (6,384)**	**$ (5,923)**	**$ (5,437)**	**$ (4,924)**	**$ (4,383)**	**$ (3,813)**

PRO FORMA AND PRODUCTION

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Annual Generation (kWh)	3,423	3,406	3,389	$ 3,372	3,355	3,338	3,321

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 968	$ 1,011	$ 1,057	$ 1,104	$ 1,153	$ 1,205	$ 1,259
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 968	$ 1,011	$ 1,057	$ 1,104	$ 1,153	$ 1,205	$ 1,259
Replace Inverter?	No	Yes	No	No	No	No	No
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (2,406)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (2,784)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 601	$ (1,773)	$ 667	$ 703	$ 740	$ 779	$ 821
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 601	$ (1,773)	$ 667	$ 703	$ 740	$ 779	$ 821
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 601	$ (1,773)	$ 667	$ 703	$ 740	$ 779	$ 821
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depre	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 601**	**$ (1,773)**	**$ 667**	**$ 703**	**$ 740**	**$ 779**	**$ 821**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 601	$ (1,773)	$ 667	$ 703	$ 740	$ 779	$ 821
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 601	$ (1,773)	$ 667	$ 703	$ 740	$ 779	$ 821
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 601**	**$ (1,773)**	**$ 667**	**$ 703**	**$ 740**	**$ 779**	**$ 821**
Cumulative Cash Flow	**$ (3,212)**	**$ (4,984)**	**$ (4,317)**	**$ (3,614)**	**$ (2,874)**	**$ (2,095)**	**$ (1,274)**

PRO FORMA AND PRODUCTI	Year 21	Year 22	Year 23	Year 24	Year 25
Project Output					
Annual Generation (kWh)	3,305	3,288	3,272	3,255	3,239
Scenario A: Non-Taxable Rebate; Pro Forma Project Economics					
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 1,315	$ 1,374	$ 1,436	$ 1,500	$ 1,567
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,315	$ 1,374	$ 1,436	$ 1,500	$ 1,567
Replace Inverter?	No	No	No	No	No
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 864	$ 909	$ 957	$ 1,006	$ 1,059
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 864	$ 909	$ 957	$ 1,006	$ 1,059
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 864	$ 909	$ 957	$ 1,006	$ 1,059
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depre	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 864**	**$ 909**	**$ 957**	**$ 1,006**	**$ 1,059**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 864	$ 909	$ 957	$ 1,006	$ 1,059
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 864	$ 909	$ 957	$ 1,006	$ 1,059
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 864**	**$ 909**	**$ 957**	**$ 1,006**	**$ 1,059**
Cumulative Cash Flow	**$ (410)**	**$ 499**	**$ 1,455**	**$ 2,462**	**$ 3,521**

BOSTON FIRE DEPARTMENT MAINTENANCE BUILDING

Table 78: BFD Maintenance Bldg PV Profile

Building	
Building Name	Boston Fire Department Maintenance Building
Building Address	900 Massachusetts Avenue Boston, MA
City Department	Boston Redevelopment Authority
Number of floors	3
Square footage (if known)	
Fuel Type(s)	
Contact Information	
Facilities Manager	Chief Peter Laizza
Phone	(617) 343-3312
Email	
Electrical Connection	
Electric Utility Company	
Floor Plan showing Electrical room	Yes / No
Roof Details	
Roof slope/angle (Flat = 0^{o})	0^{o}
Roof Orientation (S, SE, SW, etc.)	N/A
Roof Size – Square Feet	
Roof Condition: poor, fair, good, excellent, new	Good
Roof Type (asphalt, shingles, rubber membrane, etc.)	Rubber
Expected life of roof (years)	
Equipment/obstructions on the roof	Covered Stairwell
Detailed Roof Drawings available	Yes / No

Table 79: BFD Maintenance Bldg Summary of Findings

Summary of Findings	
Suited for Solar Water Heating?	No
Shading on Roof (%)	1.12%
Area of roof available for panel installation	
Number of panels installed for assessment	100 panels
DC Output of number of panels for assessment	19,500 W
Net Capacity Factor (%)	14.8%
Cost of Installation:	$10,713

Figure 58: Boston Fire Department Maintenance Building Solar Pathfinder Report

Site Report

Report Name	900 Mass Ave
Report Date	4/8/2008 1:50:38 PM
Declination	-15d 14m
Location	BOSTON, MA, Zipcode: 02114
Lat/Long	42.362 / -71.024
Weather Station	BOSTON, MA, Elevation: 5 m
Site distance	0.59 miles
Array Type	Fixed
Tilt Angle	42.36 deg
Ideal Tilt Angle	42.36 deg
Electrical Cost	0.15 ($/KWH)
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Panel Make	Evergreen Solar
Panel Model	ES-195-RL
Panel Count	100
DC Rate (per panel)	195.00 W
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	FourCorner
Layout Point Count	4

Notes: [None]

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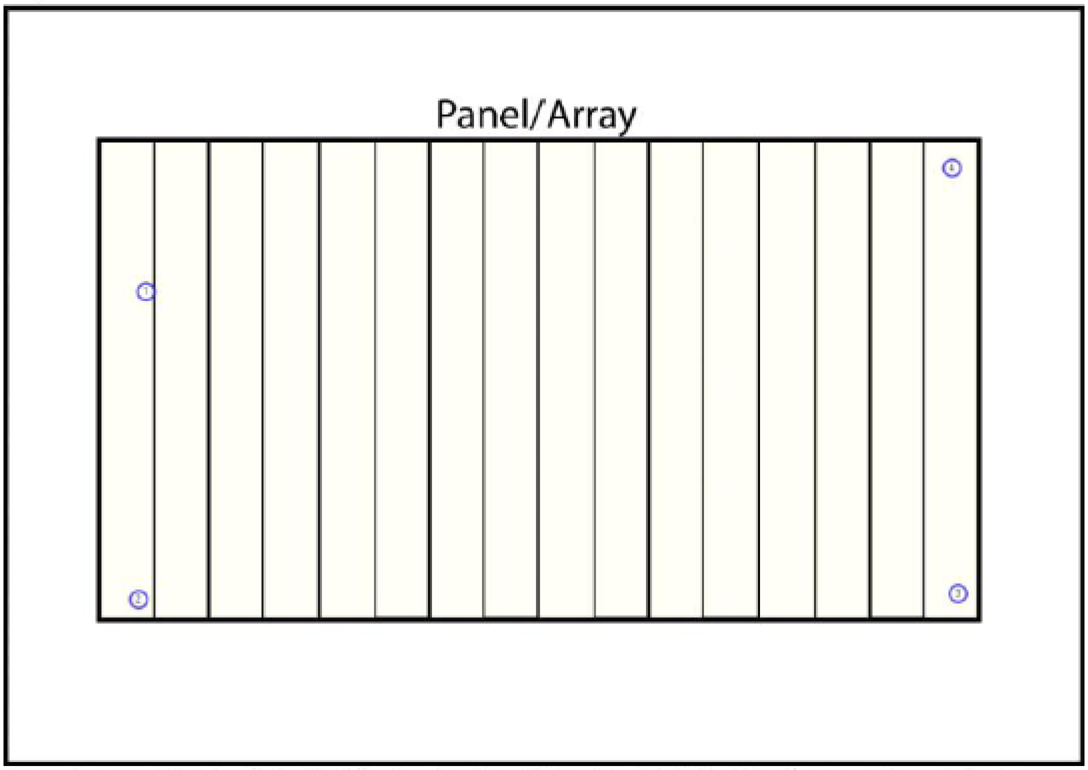
System Picture Layout

Layout Type Four Corners
Layout Point Count 4



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Solar Site Analysis Report

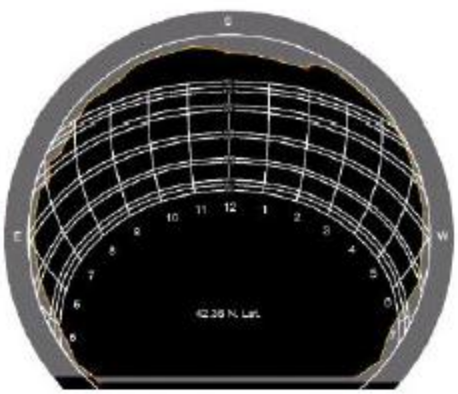
1

Image File AY2008_0408_105348.JPG

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	98.00%	3.30	1698.00	1681.88
February	99.00%	4.33	1988.00	1982.83
March	100.00%	4.78	2327.00	2325.98
April	100.00%	4.90	2262.00	2262.00
May	100.00%	5.30	2418.00	2417.74
June	100.00%	5.39	2291.00	2291.00
July	100.00%	5.58	2445.00	2444.86
August	100.00%	5.63	2481.00	2481.00
September	99.00%	5.10	2240.00	2237.08
October	98.00%	4.56	2171.00	2148.95
November	97.00%	3.04	1472.00	1437.95
December	97.00%	2.88	1470.00	1435.66
Totals	**98.88%**	**54.80**	**25263.0**	**25146.91**
	Unweighted Yearly Avg	**Effect: 99.06% Sun Hrs: 4.57**		

Notes: [None]



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Solar Site Analysis Report

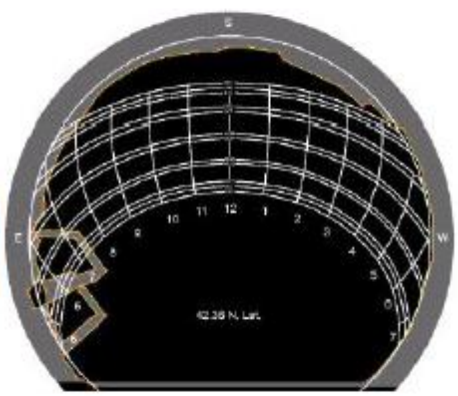
2

Image File AY2008_0408_105436.JPG

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	98.00%	3.30	1698.00	1681.88
February	99.00%	4.32	1988.00	1977.66
March	100.00%	4.78	2327.00	2326.32
April	99.00%	4.88	2262.00	2251.54
May	98.00%	5.22	2418.00	2381.52
June	97.00%	5.27	2291.00	2236.51
July	98.00%	5.48	2445.00	2403.19
August	99.00%	5.59	2481.00	2456.61
September	99.00%	5.09	2240.00	2232.22
October	98.00%	4.57	2171.00	2153.63
November	97.00%	3.05	1472.00	1443.42
December	96.00%	2.87	1470.00	1429.99
Totals	**98.29%**	**54.42**	**25263.0**	**24974.48**
	Unweighted Yearly Avg	**Effect: 98.37% Sun Hrs: 4.53**		

Notes: [None]



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Solar Site Analysis Report

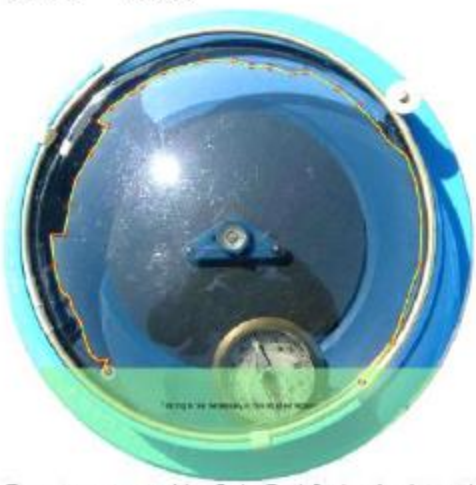
3

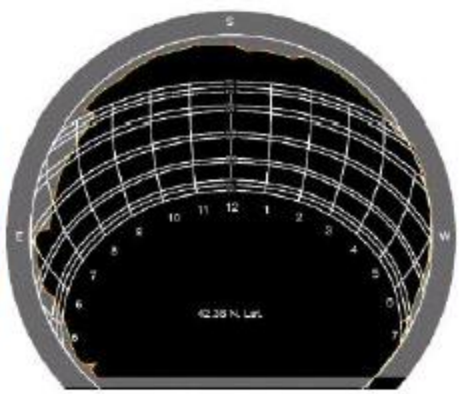
Image File AY2008_0408_105528.JPG

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	96.00%	3.21	1698.00	1636.56
February	98.00%	4.26	1988.00	1958.91
March	99.00%	4.74	2327.00	2322.00
April	100.00%	4.90	2262.00	2262.00
May	99.00%	5.30	2418.00	2417.52
June	100.00%	5.39	2291.00	2290.71
July	100.00%	5.58	2445.00	2444.71
August	100.00%	5.63	2481.00	2481.00
September	98.00%	5.05	2240.00	2223.47
October	96.00%	4.47	2171.00	2109.84
November	93.00%	2.93	1472.00	1390.22
December	94.00%	2.80	1470.00	1395.97
Totals	**97.70%**	**54.27**	**25263.0**	**24932.91**
	Unweighted Yearly Avg	**Effect: 98.11% Sun Hrs: 4.52**		

Notes: [None]





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Solar Site Analysis Report

4

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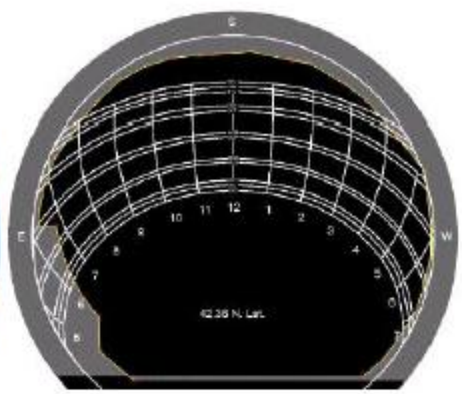
Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2/day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	98.00%	3.28	1698.00	1679.95
February	100.00%	4.35	1988.00	1986.28
March	100.00%	4.78	2327.00	2325.81
April	98.00%	4.84	2262.00	2246.10
May	98.00%	5.23	2418.00	2399.80
June	98.00%	5.30	2291.00	2272.71
July	98.00%	5.51	2445.00	2429.28
August	99.00%	5.56	2481.00	2464.90
September	99.00%	5.08	2240.00	2230.27
October	99.00%	4.60	2171.00	2163.89
November	97.00%	3.06	1472.00	1446.16
December	96.00%	2.85	1470.00	1423.64
Totals	**98.28%**	**54.43**	**25263.0**	**25068.79**
	Unweighted Yearly Avg	**Effect: 98.40% Sun Hrs: 4.54**		

Notes: [None]



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Summary Report

Solar Obstruction Data

Month	Actual Site Efficiency % Azimuth=180.0 Tilt=42.36	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.36 KWH/m^2 /day	Actual AC Power (KWH) w/o shading Azimuth=180.0 Tilt=42.4	Actual AC Power (KWH) w/ shading Azimuth=180.0 Tilt=42.4
January	97.50%	3.27	1698.00	1670.07
February	99.00%	4.32	1988.00	1976.42
March	99.75%	4.77	2327.00	2325.03
April	99.25%	4.88	2262.00	2255.41
May	98.75%	5.26	2418.00	2404.15
June	98.75%	5.34	2291.00	2272.73
July	99.00%	5.54	2445.00	2430.51
August	99.50%	5.60	2481.00	2470.88
September	98.75%	5.08	2240.00	2230.76
October	97.75%	4.55	2171.00	2144.08
November	96.00%	3.02	1472.00	1429.44
December	95.75%	2.85	1470.00	1421.32
Totals	**98.31%**	**54.80**	**25263.0**	**25030.78**
	Unweighted	**Effect: 98.49%**		
	Yearly Avg	**Sun Hrs: 4.54**		

Notes: [None]

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Table 80: BFD Maintenance Bldg MTC Rebate Estimator Summary

Commonwealth Solar Non-Residential Solar Photovoltaic Calculator

Non-Residential: Commonwealth Solar Rebate Matrix ($/watt dc)

Incremental Capacity	1 to 25 kW (1,000 to 25,000 watts)	> 25 to 100 kW	> 100 kW to 200 kW	> 200 kW to 500 kW
Base Incentive ($/watt dc)	$3.25	$2.50	$2.00	$1.50
PLUS: Additions to Base				
MA-Manufactured Components	$0.25	$0.25	$0.25	$0.25
Public Building Adder	$0.50	$0.50	$0.25	$0.25

Non-Residential: Commonwealth Solar Rebate Calculator

Total PV Project Size (watts dc)	3571
Total PV Project Size for Rebate Calculation (500 kW cap)	**3,571**
MA-manufactured components	YES
Public Building Adder	YES
Rebate ($)	**$ 14,284.00**
Rebate ($/watt dc) based on total project size	**$ 4.00000**

Click here for Financial Model

Key

Entry Cells	
Calculation Cells (not for Entry)	

DATA ENTRY AND FINANCIAL SUMMARY

Key		
Entry Cells		
Cells Draw Data from Another Worksheet		
Calculation Cells (Not for Entry)		
Select Taxable or Non-Taxable Entity	Non-Taxable	
Project and Customer Cost Assumptions		
Solar Photovoltaic System Size	3,571	Watts (DC STC)
Total System Cost/Watt	$ 7.00	$/Watt (DC STC)
Total System Cost	$ 24,997	
MTC Rebate Assumptions		
MTC Scenario A: Non-Taxable Rebate	$ 4.000	$/Watt (DC STC)
Scenario A Rebate	$ 14,284	
MTC Scenario B: Taxable Rebate	$ 4.570	$/Watt (DC STC)
Scenario B Rebate	$ 16,319	
Project Performance and Savings/ Cost Assumptions		
Annual Net Capacity Factor	14.7%	kW (DC STC) to kWh AC
Annual Production Degradation	0.50%	%
Project Life	25	Years
Electricity Revenue (Avoided Costs)	$ 0.15	$/kWh
Electricity Revenue (Avoided Costs) Annual Adjustor	5.0%	%
Renewable Energy Certificate (REC) Revenue	$ 0.03	$/kWh
REC Revenue Annual Adjustor	0.0%	%
REC Revenue Term	3	Years (must be equal to or less than project life)
Annual Operations and Maintenance Cost	$ 250	$/Year
Annual Operations and Maintenance Adjustor	3.0%	%
Future Inverter Replacement Cost	$ 0.75	$/Watt (DC STC)
Inverter Life, Replace Every X Years	15	Year (must be equal to or less than project life)

Scenario Definitions

Scenario A: Non-Taxable Rebate - Assumes that the state rebate is non-taxable, but is subtracted from the cost basis for purposes of

Scenario B: Taxable Rebate - Assumes that the state rebate is taxable, but is not subtracted from the cost basis for purposes of deter

Both Scenarios assume that the project owner can use both federal and state tax benefits

Tax Assumptions

Federal Tax Rate	0%					
State Tax Rate	0%					
Effective Tax Rate	0%					
Federal Tax Credit	0%					
State Tax Deduction	0%					
5 Year Accelerated Depreciation Schedule (MACRS)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Financing Assumptions

% Financed w/ Cash	100%	
% Financed w/ Loan	0%	
Loan Interest Rate	8%	
Loan Period	20	Years (must be equal to or less than project life)
Scenario A Net Cost	$ 10,713	
Scenario A Loan	$ -	
Scenario B Net Cost	$ 8,678	
Scenario B Loan	$ -	
Customer Discount Rate	6%	

Solar Project Financial Analysis Summary

Scenario A: Net Present Value	**$ (2,033)**
Scenario A: Simple Payback (100% Cash only)	**Year 19**
Scenario A: Estimated Return on Equity	**#DIV/0!**
Scenario A: Guess Return on Equity	50%
Scenario B: Net Present Value	**$ 2**
Scenario B: Simple Payback (100% Cash only)	**Year 14**
Scenario B: Estimated Return on Equity	**#DIV/0!**
Scenario B: Guess Return on Equity	50%

PRO FORMA AND PRODUCTION

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Annual Generation (kWh)		4,583	4,560	4,537	4,514	4,492	4,469
Scenario A: Non-Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 687	$ 718	$ 750	$ 784	$ 819	$ 856
REC Revenue		$ 137	$ 137	$ 136	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 825	$ 855	$ 886	$ 784	$ 819	$ 856
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 575	$ 597	$ 621	$ 511	$ 538	$ 566
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 575	$ 597	$ 621	$ 511	$ 538	$ 566
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 575	$ 597	$ 621	$ 511	$ 538	$ 566
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Net Income		**$ 575**	**$ 597**	**$ 621**	**$ 511**	**$ 538**	**$ 566**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 575	$ 597	$ 621	$ 511	$ 538	$ 566
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 575	$ 597	$ 621	$ 511	$ 538	$ 566
Cash From Investing							
Installed PV Cost	$ (10,713)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (10,713)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ (10,713)**	**$ 575**	**$ 597**	**$ 621**	**$ 511**	**$ 538**	**$ 566**
Cumulative Cash Flow	**$ (10,713)**	**$ (10,138)**	**$ (9,541)**	**$ (8,919)**	**$ (8,409)**	**$ (7,871)**	**$ (7,305)**

PRO FORMA AND PRODUCTION

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Annual Generation (kWh)	4,447	4,425	4,403	4,381	4,359	4,337	4,315

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 894	$ 934	$ 976	$ 1,019	$ 1,065	$ 1,113	$ 1,162
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 894	$ 934	$ 976	$ 1,019	$ 1,065	$ 1,113	$ 1,162
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 595	$ 626	$ 659	$ 693	$ 729	$ 767	$ 806
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 595	$ 626	$ 659	$ 693	$ 729	$ 767	$ 806
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 595	$ 626	$ 659	$ 693	$ 729	$ 767	$ 806
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 595**	**$ 626**	**$ 659**	**$ 693**	**$ 729**	**$ 767**	**$ 806**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 595	$ 626	$ 659	$ 693	$ 729	$ 767	$ 806
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 595	$ 626	$ 659	$ 693	$ 729	$ 767	$ 806
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 595**	**$ 626**	**$ 659**	**$ 693**	**$ 729**	**$ 767**	**$ 806**
Cumulative Cash Flow	**$ (6,710)**	**$ (6,083)**	**$ (5,424)**	**$ (4,731)**	**$ (4,002)**	**$ (3,236)**	**$ (2,430)**

PRO FORMA AND PRODUCTION

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Annual Generation (kWh)	4,294	4,272	4,251	$ 4,230	4,208	4,187	4,166

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 1,214	$ 1,269	$ 1,326	$ 1,385	$ 1,447	$ 1,512	$ 1,579
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,214	$ 1,269	$ 1,326	$ 1,385	$ 1,447	$ 1,512	$ 1,579
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (2,678)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (3,056)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 847	$ (1,788)	$ 936	$ 984	$ 1,034	$ 1,086	$ 1,141
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 847	$ (1,788)	$ 936	$ 984	$ 1,034	$ 1,086	$ 1,141
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 847	$ (1,788)	$ 936	$ 984	$ 1,034	$ 1,086	$ 1,141
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 847**	**$ (1,788)**	**$ 936**	**$ 984**	**$ 1,034**	**$ 1,086**	**$ 1,141**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 847	$ (1,788)	$ 936	$ 984	$ 1,034	$ 1,086	$ 1,141
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 847	$ (1,788)	$ 936	$ 984	$ 1,034	$ 1,086	$ 1,141
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 847**	**$ (1,788)**	**$ 936**	**$ 984**	**$ 1,034**	**$ 1,086**	**$ 1,141**
Cumulative Cash Flow	**$ (1,582)**	**$ (3,370)**	**$ (2,434)**	**$ (1,450)**	**$ (416)**	**$ 670**	**$ 1,811**

PRO FORMA AND PRODUCTION

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Annual Generation (kWh)	4,146	4,125	4,104	4,084	4,063

Scenario A: Non-Taxable Rebate; Pro Forma Project Economics

	Year 21	Year 22	Year 23	Year 24	Year 25
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 1,650	$ 1,724	$ 1,801	$ 1,882	$ 1,966
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,650	$ 1,724	$ 1,801	$ 1,882	$ 1,966
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 1,198	$ 1,259	$ 1,322	$ 1,388	$ 1,458
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 1,198	$ 1,259	$ 1,322	$ 1,388	$ 1,458
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 1,198	$ 1,259	$ 1,322	$ 1,388	$ 1,458
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Net Income	**$ 1,198**	**$ 1,259**	**$ 1,322**	**$ 1,388**	**$ 1,458**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 1,198	$ 1,259	$ 1,322	$ 1,388	$ 1,458
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 1,198	$ 1,259	$ 1,322	$ 1,388	$ 1,458
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Annual Cash Flow	**$ 1,198**	**$ 1,259**	**$ 1,322**	**$ 1,388**	**$ 1,458**
Cumulative Cash Flow	**$ 3,009**	**$ 4,268**	**$ 5,590**	**$ 6,978**	**$ 8,435**

Project Output	Start-Up 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)		$ 687	$ 718	$ 750	$ 784	$ 819	$ 856
REC Revenue		$ 137	$ 137	$ 136	$ -	$ -	$ -
Total Revenue (Avoided Costs)		$ 825	$ 855	$ 886	$ 784	$ 819	$ 856
Operations & Maintenance Costs		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
Inverter Replacement Cost		$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses		$ (250)	$ (258)	$ (265)	$ (273)	$ (281)	$ (290)
EBITDA		$ 575	$ 597	$ 621	$ 511	$ 538	$ 566
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBIT		$ 575	$ 597	$ 621	$ 511	$ 538	$ 566
Interest Expense		$ -	$ -	$ -	$ -	$ -	$ -
EBT		$ 575	$ 597	$ 621	$ 511	$ 538	$ 566
Federal taxes saved/(paid)		$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]		$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate		$ -					
Net Income		**$ 575**	**$ 597**	**$ 621**	**$ 511**	**$ 538**	**$ 566**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income		$ 575	$ 597	$ 621	$ 511	$ 538	$ 566
Federal Depreciation Expense		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations		$ 575	$ 597	$ 621	$ 511	$ 538	$ 566
Cash From Investing							
Installed PV Cost	$ (8,678)						
One Time State Solar Investment Tax Deduction (Actual Cash Value)		$ -					
One Time Federal Solar Investment Tax Credit		$ -					
Cash Flow From Investing	$ (8,678)	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement	$ -						
Loan Repayment (Principle)		$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ (8,678)**	**$ 575**	**$ 597**	**$ 621**	**$ 511**	**$ 538**	**$ 566**
Cumulative Cash Flow	**$ (8,678)**	**$ (8,103)**	**$ (7,505)**	**$ (6,884)**	**$ (6,373)**	**$ (5,836)**	**$ (5,270)**

Project Output	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 894	$ 934	$ 976	$ 1,019	$ 1,065	$ 1,113	$ 1,162
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 894	$ 934	$ 976	$ 1,019	$ 1,065	$ 1,113	$ 1,162
Operations & Maintenance Costs	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (299)	$ (307)	$ (317)	$ (326)	$ (336)	$ (346)	$ (356)
EBITDA	$ 595	$ 626	$ 659	$ 693	$ 729	$ 767	$ 806
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 595	$ 626	$ 659	$ 693	$ 729	$ 767	$ 806
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 595	$ 626	$ 659	$ 693	$ 729	$ 767	$ 806
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 595**	**$ 626**	**$ 659**	**$ 693**	**$ 729**	**$ 767**	**$ 806**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 595	$ 626	$ 659	$ 693	$ 729	$ 767	$ 806
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 595	$ 626	$ 659	$ 693	$ 729	$ 767	$ 806
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 595**	**$ 626**	**$ 659**	**$ 693**	**$ 729**	**$ 767**	**$ 806**
Cumulative Cash Flow	**$ (4,674)**	**$ (4,048)**	**$ (3,389)**	**$ (2,696)**	**$ (1,967)**	**$ (1,200)**	**$ (394)**

Project Output	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Scenario B: Taxable Rebate; Pro Forma Project Economics							
INCOME STATEMENT							
Electricity Revenue (Avoided Cost)	$ 1,214	$ 1,269	$ 1,326	$ 1,385	$ 1,447	$ 1,512	$ 1,579
REC Revenue	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,214	$ 1,269	$ 1,326	$ 1,385	$ 1,447	$ 1,512	$ 1,579
Operations & Maintenance Costs	$ (367)	$ (378)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
Inverter Replacement Cost	$ -	$ (2,678)	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (367)	$ (3,056)	$ (389)	$ (401)	$ (413)	$ (426)	$ (438)
EBITDA	$ 847	$ (1,788)	$ 936	$ 984	$ 1,034	$ 1,086	$ 1,141
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBIT	$ 847	$ (1,788)	$ 936	$ 984	$ 1,034	$ 1,086	$ 1,141
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EBT	$ 847	$ (1,788)	$ 936	$ 984	$ 1,034	$ 1,086	$ 1,141
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate							
Net Income	**$ 847**	**$ (1,788)**	**$ 936**	**$ 984**	**$ 1,034**	**$ 1,086**	**$ 1,141**
CASH FLOW STATEMENT							
Cash From Operations							
Net Income	$ 847	$ (1,788)	$ 936	$ 984	$ 1,034	$ 1,086	$ 1,141
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 847	$ (1,788)	$ 936	$ 984	$ 1,034	$ 1,086	$ 1,141
Cash From Investing							
Installed PV Cost							
One Time State Solar Investment Tax Deduction (Actual Cash Value)							
One Time Federal Solar Investment Tax Credit							
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash From Financing							
Loan Disbursement							
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 847**	**$ (1,788)**	**$ 936**	**$ 984**	**$ 1,034**	**$ 1,086**	**$ 1,141**
Cumulative Cash Flow	**$ 453**	**$ (1,334)**	**$ (398)**	**$ 585**	**$ 1,619**	**$ 2,705**	**$ 3,846**

Project Output	Year 21	Year 22	Year 23	Year 24	Year 25
Scenario B: Taxable Rebate; Pro Forma Project Economics					
INCOME STATEMENT					
Electricity Revenue (Avoided Cost)	$ 1,650	$ 1,724	$ 1,801	$ 1,882	$ 1,966
REC Revenue	$ -	$ -	$ -	$ -	$ -
Total Revenue (Avoided Costs)	$ 1,650	$ 1,724	$ 1,801	$ 1,882	$ 1,966
Operations & Maintenance Costs	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
Inverter Replacement Cost	$ -	$ -	$ -	$ -	$ -
Total Operating Expenses	$ (452)	$ (465)	$ (479)	$ (493)	$ (508)
EBITDA	$ 1,198	$ 1,259	$ 1,322	$ 1,388	$ 1,458
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
EBIT	$ 1,198	$ 1,259	$ 1,322	$ 1,388	$ 1,458
Interest Expense	$ -	$ -	$ -	$ -	$ -
EBT	$ 1,198	$ 1,259	$ 1,322	$ 1,388	$ 1,458
Federal taxes saved/(paid)	$ -	$ -	$ -	$ -	$ -
State taxes saved/(paid) [can not deduct federal depreciation expense]	$ -	$ -	$ -	$ -	$ -
Federal and State Tax on MTC Capital Cost Rebate					
Net Income	**$ 1,198**	**$ 1,259**	**$ 1,322**	**$ 1,388**	**$ 1,458**
CASH FLOW STATEMENT					
Cash From Operations					
Net Income	$ 1,198	$ 1,259	$ 1,322	$ 1,388	$ 1,458
Federal Depreciation Expense	$ -	$ -	$ -	$ -	$ -
Cash Flow From Operations	$ 1,198	$ 1,259	$ 1,322	$ 1,388	$ 1,458
Cash From Investing					
Installed PV Cost					
One Time State Solar Investment Tax Deduction (Actual Cash Value)					
One Time Federal Solar Investment Tax Credit					
Cash Flow From Investing	$ -	$ -	$ -	$ -	$ -
Cash From Financing					
Loan Disbursement					
Loan Repayment (Principle)	$ -	$ -	$ -	$ -	$ -
Cash Flow From Financing	$ -	$ -	$ -	$ -	$ -
Net Cash Flow	**$ 1,198**	**$ 1,259**	**$ 1,322**	**$ 1,388**	**$ 1,458**
Cumulative Cash Flow	**$ 5,044**	**$ 6,303**	**$ 7,625**	**$ 9,013**	**$ 10,471**

APPENDIX O: PANEL CALCULATIONS EXCEL SHEET

We created a Microsoft Excel spreadsheet (see Table 81) to organize the data we found during our analysis. Our first calculation involved reducing the area of the roof by twenty percent. We were told by Wilson Rickerson, the Solar Boston Coordinator for the City of Boston that a twenty percent reduction would account for the average area of roof taken up by heating and ventilation systems and other obstructions that are on the roof. We used the reduced area to calculate the number of solar panels that could be installed on each roof. We also used this area to determine the estimated KW production of the panels.

The estimated KW production using Spruce line Evergreen solar panels was calculated by using Equation 4.

Equation 4: Estimated KW Production

$$\frac{40\%\ Roof\ Area}{6.3\ m^2/KW} = Estimated\ KW\ Production$$

The approximate number of panels was estimated by using Equation 5_.

Equation 5: Approximate Number of Panels

$$\frac{40\%\ Roof\ Area}{16.3m/panel} = Approximate\ Number\ of\ Panels$$

The actual AC power was determined using the Solar Pathfinder Assistant Software.

The annual net capacity factor was found using Equation 6.

Equation 6: Annual Net Capacity Factor

$$\frac{Actual\ AC\ Power\ with\ Shading}{0.195\ KW \times Approximate\ Number\ of\ Panels \times 8760\ hrs/yr} = Annaul\ Net\ Capacity\ Factor$$

The amount of DC Watt production was determined using Equation 7.

Equation 7: DC Watt Production

$$\frac{\left(\frac{Actual\ AC\ Power\ with\ Shading}{0.8}\right) \times 1000\ W/KW}{8760\ hr/yr} = DC\ Watt\ Production$$

Finally, the Site Efficiency was determined using the Solar Pathfinder Assistant Software. This percentage was calculated from the shading analysis we conducted.

Table 81: Panel Calculations Excel Sheet

Building	40% roof area (sq ft)	kW Capacity using Spruce Line	Number of Panels (approx)	Actual AC Power w/Shading	Annual Net Capacity Factor	DC Power (Watts)	Site Efficiency %
Brighton High School	86485.2	1275.355287	5391.845	218266.92	12.7776	31145.39	96.15%
Central Maintenance	33039.8	487.2219016	2059.838	223940	13.10971	31954.91	98.63%
Curley Community Center	29214	430.804685	1821.322	251702	14.73493	35916.38	99%
Tobin Community Center	9298.772	137.1244794	579.7239	126459.46	12.78598	18045.01	95.19%
Fire Engine 41	2740.7	40.41577327	170.8666	37143.23	12.79063	5300.118	96.17%
Frankling Park Administration Building	17405.75	256.6741805	1085.147	18456.56	10.80468	2633.642	78.21%
West Roxbury Branch Library	4943.084	72.89326164	308.1723	60764	11.54933	8670.662	86%
Office-1010 Mass Ave	13000	191.7046931	810.4738	192572	11.27339	27478.88	91.69%
Strand Theater	6434.28	94.88320561	401.1397	100669	14.69646	14364.87	98.73%
Maintence Shops 112 Southampton	11172.4	164.7539626	696.5337	147522	12.4082	21050.51	91%

GLOSSARY

1. **Biofuel -** n. Fuel such as methane produced from renewable biological resources such as plant biomass and treated municipal and industrial waste.
2. **Biomass -** n. Energy. Organic matter, esp. plant matter, that can be converted to fuel and is therefore regarded as a potential energy source.
3. **Ethanol** - n. The intoxicating agent in fermented and distilled liquors; used pure or denatured as a solvent or in medicines and colognes and cleaning solutions and rocket fuel; proposed as a renewable clean-burning additive to gasoline
4. **Fossil Fuels -** Coal, petroleum, and natural gas.
5. **Geostationary Satellites -** See Geosynchronous Satellite
6. **Geosynchronous satellite -** n. A satellite whose orbital track on the Earth repeats regularly over points on the Earth over time. If such a satellite's orbit lies over the equator and the orbit is circular, it is called a geostationary satellite.
7. **Geothermal Gradient -** n. The increase in temperature with increasing depth within the earth.
8. **Green Technology -** n. Any technology that is environmentally friendlier than a comparable existing technology.
9. **Photon -** n. The quantum of electromagnetic energy, regarded as a discrete particle having zero mass, no electric charge, and an indefinitely long lifetime.
10. **Photovoltaic (PV) -** adj. Capable of producing a voltage when exposed to radiant energy, especially light.
11. **Semiconductor -** n. A substance, as silicon or germanium, with electrical conductivity intermediate between that of an insulator and a conductor: a basic component of various kinds of electronic circuit element (semiconductor device) used in communications, control, and detection technology and in computers.

12. **Solar Cell** – n. A photovoltaic cell that converts sunlight directly into electricity.

13. **Solar Panel** – n. A bank of solar cells.

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