GMIA Solar Energy Feasibility Study

Tasks 2 & 3 Report: Financial and Legal Issues

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Prepared for:

Milwaukee County Department of Transportation

General Mitchell International Airport

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Executive Summary

Milwaukee County's General Mitchell International Airport (GMIA) has engaged Harris Miller Miller & Hanson Inc. (HMMH) to evaluate the technical and financial feasibility of siting a large-scale solar photovoltaic (PV) generating facility on airport property. The facility would have a minimum nameplate capacity of 1 MW which requires approximately 5 acres of land and is generally enough electricity to supply 150 homes in Wisconsin. HMMH is supported in this study by Mead & Hunt for airport planning, Jacobsen Daniels Associates for airport financial analysis, and Richard Gross Inc. for utility interconnection.

Under Task 1, the project team initially identified 15 potential sites where a solar PV system might be located based on a review of the airport property and existing and future uses. HMMH then evaluated the 15 sites based on several evaluation factors including consistency with the Master Plan, viability to interconnect with existing electrical infrastructure, ability to avoid and minimize environmental impacts, and compatibility with airspace protection issues particularly solar glare.

The results of the study indicate that a number of sites may be viable for developing a 1 MW solar PV facility on airport property and could provide financial benefit to the airport. Sites located near the terminal complex appear to provide the best opportunities given the proximity to existing electrical infrastructure and the corresponding affect in limiting project costs. Only two sites, located on the east side of the airport, were determined to not comply with the FAA's Interim Solar Policy on solar glare. The viability of a number of sites located on the north, south and east sides of the airport property may be feasible subject to future discussions with local utility, We Energies, given that each would require a direct connection to the We Energies distribution network.

This report addresses Tasks 2 and 3 of the study which are focused on assessing the economic and legal aspects of developing a large scale solar PV project on airport property. In addressing these tasks, we have reviewed financing mechanisms available to the airport, should it own the system, as well as those available to a private developer, should the airport pursue a third party lease agreement. The project team has directly engaged We Energies to verify the interconnection options and process, and has researched the current status of Wisconsin energy regulatory policy and the viability of public-private ownership models. This information has been used to prepare an analysis of the financial options available to funding the project either through an airport-owned and a third party-owned structure. This analysis is focused on the four sites located closest to the terminal electrical meter and considered most viable from a siting perspective:

- Site 1, solar carports on the employee parking lot
- Site 13, ground-mounted facility at the south spur near airport entrance
- Site 14, ground-mounted facility at the north spur near airport entrance
- Site 15, solar carports on top of parking garage roof

Findings of the analysis presented in this report include:

- The most cost-effective option and the only one that results in a positive annual return would be an airport-owned project funded with a 75% grant under the Airport Improvement Program (AIP). However, the airport has other airport capital projects committed for future funding which have already been approved by the airlines and replacing those with a solar project will be challenging to demonstrate on a direct cost-effectiveness basis.
- A third party would require the airport or other entity to purchase the electricity output from the facility at 17.6 ¢ / kWh to achieve a 10% investor rate of return. While the state of Wisconsin has a Renewable Portfolio Standard which requires utilities to deliver a minimum amount of

renewable energy to its customers (10% by 2015) which is a driver for purchasing renewable energy at above market electricity rates, the utilities are meeting that mandate by purchasing wind, hydropower, and biomass which is currently being produced more economically in the region compared to solar generation.

- The airport is eligible for a Renewable Energy Competitive Incentive Program (RECIP) which provides incentives for business for cost effective renewable energy under the Focus on Energy utility incentive programs. Even if it received the maximum grant of $500,000 to decrease the initial cost of a 1 MW project and used energy bonds to fund the remainder, the project would still result in a negative annual return to the airport. An alternative option could be to fund a smaller project (e.g., 250-500 kW) with a lower airport investment which could prove to be cost-effective.
- As a large user of electricity and with a new circuit recently constructed which expands electricity delivery capacity to the Terminal complex, there is opportunity to install a utility scale solar project behind-the-meter and maximize the direct use of the power at the Terminal. What limits the economic viability of this option is the relatively low energy rate that the airport pays for electricity during on-peak hours (8am to 8pm) when the solar facility would generate power and the airport would purchase less electricity from the utility. The airport pays an on-peak rate of 7.7 ¢ / kWh. As a comparison, the reported summer peak rate for commercial customers in Minneapolis-St. Paul (Xcel service territory) is 14.3 ¢ / kWh. With a lower electricity rate, it takes the airport a longer period to achieve the savings necessary to payback the investment in the solar facility.
- Many airports lease land to a private developer who executes a power purchase agreement (PPA) with the airport to purchase the electricity and share in the financial benefit. While other states have passed legislation specifically allowing PPA arrangements, the law in Wisconsin supporting the legality of PPAs is unclear and the utilities may contend that PPAs are not allowed under current law. A recent Supreme Court decision in Iowa found in favor of a solar company and a PPA agreement to sell power produced from a solar PV facility to the City of Dubuque. Legislation is currently before the legislature in Georgia that would clarify its law to specifically allow solar PPAs. There is an active campaign to enact similar legislation in Wisconsin. Absent legislation or formal policy from We Energies, there remains legal risk associated with a third party ownership agreements financed through a PPA.
- We Energies has expressed interest regarding participation in a solar energy project of larger-scale (e.g., 1 MW or larger) at GMIA.

While the airport can physically host a solar PV project on its property that would be compatible with airport safety, the existing electricity pricing structure, uncertainty about third party power contracts, and current commitment to airport infrastructure program significantly limits the financial viability of a solar project at GMIA. For the airport to advance its evaluation of a solar project at GMIA, it must determine We Energies level of participation in such a project and obtain clarity on the issue of third party contracts for electricity from the Public Utility Commission and/or the State Legislature.

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1 Project Background

Milwaukee County's General Mitchell International Airport (GMIA) seeks to evaluate the technical and financial feasibility of siting a large-scale solar photovoltaic (PV) generating facility on airport property. The facility would have a minimum nameplate capacity of 1 MW which requires approximately 5 acres of land and is generally enough electricity to supply 150 homes in Wisconsin. Harris Miller Miller & Hanson Inc. (HMMH) has been selected to prepare a feasibility study for GMIA. We are supported in this effort by Mead & Hunt for airport planning, Jacobsen Daniels Associates for airport financial, and Richard Gross for utility interconnection.

At least 70 solar PV projects have been developed at airports in the U.S (see Figure 1-1). They range in size from 10 kW systems which is enough electricity to supply a couple of homes to the 25 MW facility operating at Indianapolis International Airport which is sufficient to supply electricity to 3,200 homes. Smaller facilities are located on building rooftops. Larger facilities are mounted on poles piled into the ground covering acres of land. More recently, projects are being constructed over surface parking areas to provide both shelter and electricity. Of note, there is currently a 16.56 kW solar array on the roof of the National Guard Hangar adjacent to GMIA.

Airports are well suited for solar PV because they have open land and large buildings to locate solar, many consume a significant amount of electricity on-site which makes the solar electricity less costly, and solar can contribute to meeting government renewable energy objectives that the airport may be subject to. However, the feasibility of individual projects depends on a number of site-specific factors including project siting, capacity of existing infrastructure, existing electricity prices, state energy policy, and coordination with the local utility.

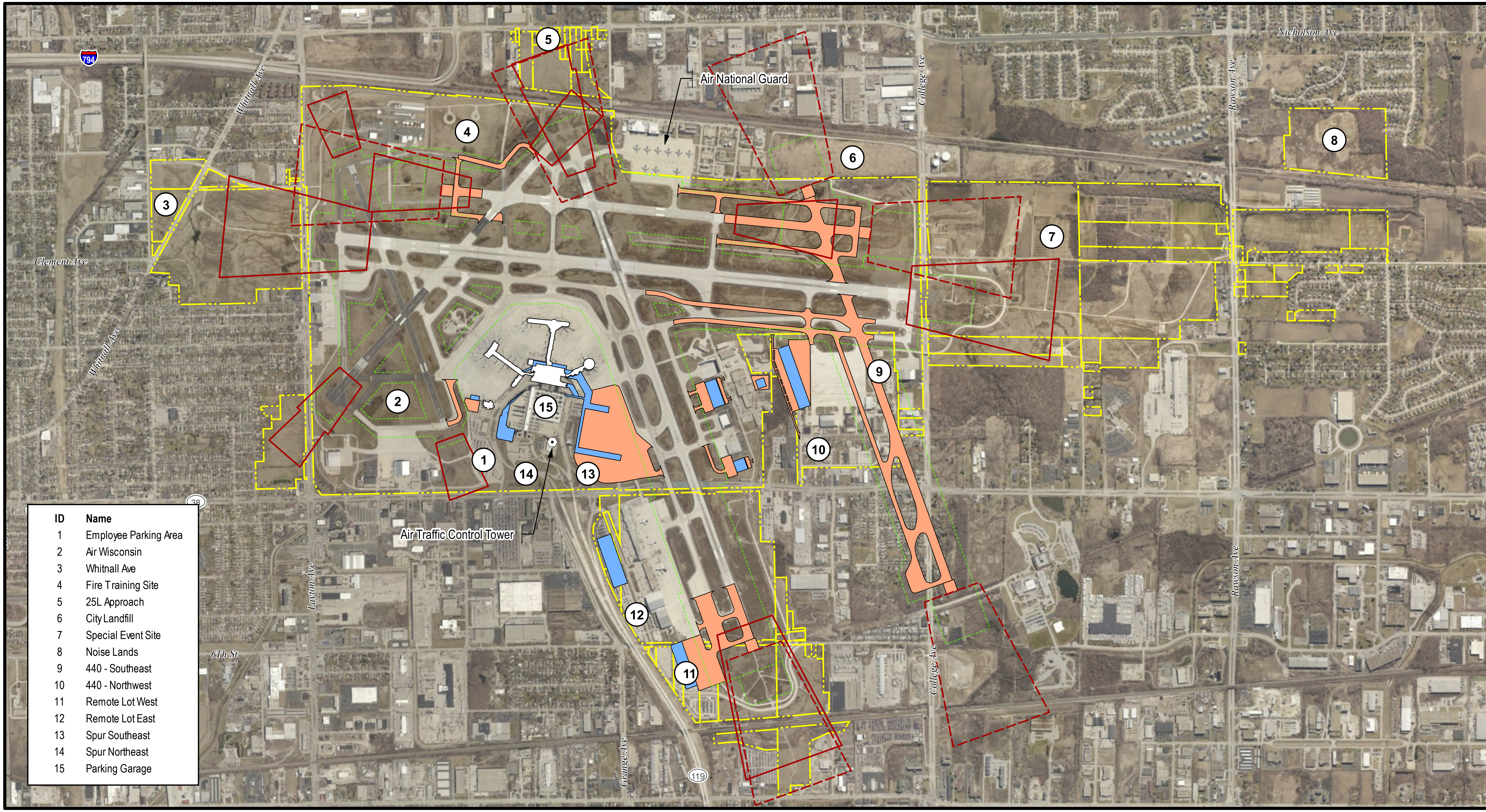
1.1 Purpose of Solar Feasibility Study

The purpose of this project is to provide technical and financial information to assess the viability of generating solar electricity at GMIA. The feasibility study is being completed under three tasks:

1. Airport Land Use Technical Analysis: determine if there is a feasible site on airport property for a nominal 1 MW solar project and if such a site would be compatible with the airport's master plan and core aviation activities.
2. Energy Usage and Economic Analysis: assess the financial benefit of a project through forecasting annual electricity production, estimating development costs and revenue produced over the project life, and assessing ownership structure options.
3. Legal Review and Coordination with Local Utility: confirm the regulatory feasibility of the proposed project and provide an outline of approval steps and timelines.

HMMH has completed and submitted the Task 1 Report. We concluded that there are multiple options for siting a 1 MW solar facility at GMIA that would be compatible with existing aeronautical uses, environmental conditions, and could potentially be interconnected to the electrical network cost effectively. The initial list of 15 sites is shown on Figure 1-2. Only sites 4 and 5 were determined to be non-compliant with the Federal Aviation Administration's (FAA) Interim Policy on Solar on Airport Property and the ocular hazard standard which evaluates potential impacts of glint and glare. All other sites were determined to be compatible with the FAA Interim Policy. Preferred sites are those that are located in close proximity to existing electrical network infrastructure and avoid environmental resources. HMMH prioritized the sites and determined that Sites 1, 13, 14, and 15 located near the main electrical feeder to the airport terminal provided the best opportunity. Based on the results of the Task 1 Report, HMMH was directed to evaluate the financial and legal issues associated with developing the solar project under Tasks 2 and 3.

Figure 1-1. Solar Projects at Airports in the U.S.



0 1,600 3,200 Feet

Airport Property Boundary
Airport Terminal Buildings
Future Airport Buildings
Future Airport Runways/Taxiways
Active Runway Protection Zone (RPZ)
Future Runway Protection Zone (RPZ)
Object Free Area (OFA)

General Mitchell International Airport
Milwaukee, Wisconsin

Figure 1-2
Potential Solar Project Sites

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This Task 2/3 report evaluates the economic and legal issues associated with the top four project sites identified in the Task 1 report:

- Site 1, carports on the employee parking lot
- Site 13, ground-mount in south spur near airport entrance
- Site 14, ground-mount in north spur near airport entrance
- Site 15, carports on top of garage roof

The report is organized in five sections. Following this background information, Section 2 reviews the airport's energy usage patterns and the forecasted electricity generation for each of the four sites identified and provides an assessment of the potential advantages and disadvantages to the ownership options given the airport's energy usage.

Section 3 reviews the two primary scenarios for ownership and implications on financing: airport-owned and third party-owned. The airport-owned scenario reviews the cost of constructing the facility and simple payback based on the cost of electricity supplied by the solar facility that otherwise would have been purchased from the utility. The third party-owned scenario assesses the cost of electricity that would be necessary in a power purchase agreement (PPA) to provide for the financial needs of investors.

Section 4 reviews the legal issues associated with large scale solar development in Wisconsin, coordination with We Energies, and steps for project implementation. This includes a summary of state solar and interconnection policies in Wisconsin, information provided by We Energies on the interconnection process, and other permitting and approval steps from the FAA and City of Milwaukee. Section 5 presents the conclusions and recommendations.

1.2 Overview of Project Sites Considered

As introduced above, the Task 1 Report evaluated 15 sites on airport property. Governed primarily by the proximity to existing electrical infrastructure that can accommodate the power without incurring additional development costs, the most suitable sites selected were those located in close proximity to the airport terminal where We Energies recently installed a new electrical feeder to the airport to address future airport expansion and electricity capacity needs.

Four sites were selected as preferred and each was evaluated for potential glare impacts on airport sensitive receptors in accordance with the FAA's Interim Solar Policy. A footprint and basic project design (with a tilt angle and orientation) was identified that is consistent with the ocular hazard standard described in the FAA's Policy. Some of the sites required a modification to a standard preferred design where the panels are oriented due south (compass orientation of 180°) however the compliant design was determined to produce a sufficient amount of electricity to warrant further consideration (that is the reduction in electricity generation from the preferred design to the compliant design was small). The following section provides a brief overview of the four project sites including the primary design elements evaluated in this report. Figure 1-3 shows the location of the four sites and the location of the electrical interconnection points.

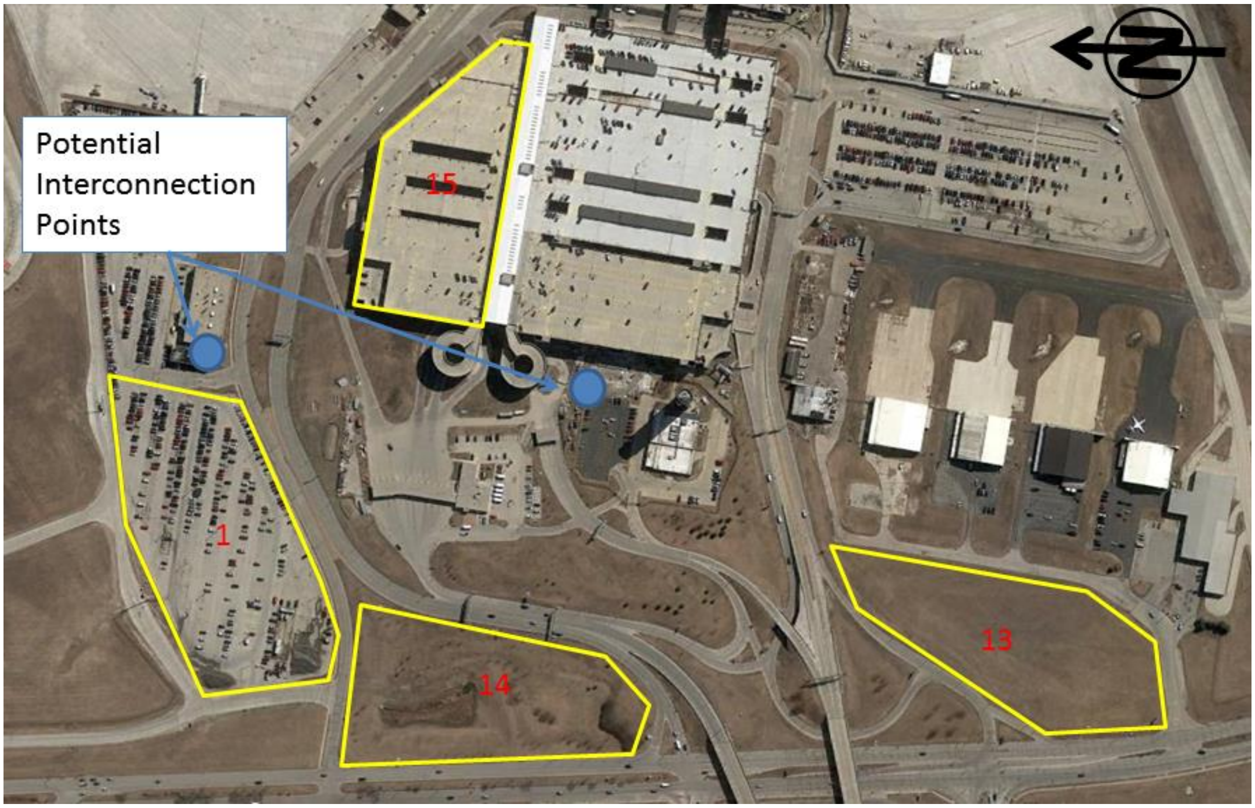

Figure 1-3. Terminal Area Solar Project Sites and Interconnection Points

1.3 Site 1 – Solar Carports on Employee Parking Lot

Site 1 is the existing employee parking area. The site is located north and west of the terminal, parking garage and control tower. The existing characteristic of the sites is as a flat, paved parking lot. The solar panels would be constructed on top of carport structures that would allow cars to park beneath the structures providing the added benefit of covered parking. The site is adjacent to an existing electrical interconnection point which will minimize interconnection costs.

The standard design with an orientation of 180° did not meet the FAA's ocular hazard standard. The design was modified and an orientation of 155° (i.e. toward the southeast) produced results consistent with the FAA Policy. The design also relies on solar panels constructed on carport structures that would permit continued use of the parking lot and provide a benefit of covered parking. Use of carports has a higher installed cost due to the extra material associated with the support structures. The financial analysis utilizes the higher installed cost associated with carports.

1.4 Site 13 – South Spur Near Airport Entrance

Site 13 is an open, relatively flat and grassy area just south of the main airport entrance and west of existing aircraft hangars. Solar panels would be located on ground-mounted structures and interconnected to a new substation adjacent to the parking garage.

Project site 13 met the FAA's ocular hazard standard utilizing the preferred design with a 25° tilt angle oriented due south at 180°. Therefore, the site will produce the maximum amount of solar electricity given footprint size and geographic location. The project would be installed with a fixed ground-mount system which results in the lowest installed cost design.

1.5 Site 14 – North Spur Near Airport Main Entrance

Site 14 is also an open grassy area but located just north of the main airport entrance. It has some landscaped features and a detention pond which may require some site improvements to accommodate a solar project. Such a project would, like Site 13, be ground mounted on poles and interconnected to the new substation next to the parking garage.

Project site 14 did not meet the FAA's ocular hazard standard using the preferred design. A variety of alternatives were evaluated and a design with a tilt angle of 25° and an orientation of 250° to the southwest was identified as being compliant. This project would also be installed with a fixed ground-mount system which results in the lowest installed cost design.

1.6 Site 15 – Solar Carports on Top of Parking Garage

Site 15 is located on top of the parking garage. Similar to Site 1, solar panels would be located on top of carport structures and provide the supplemental benefit of covered parking. The electrical interconnection would also be directed to the new substation adjacent to the parking garage.

Site 15 also did not meet the FAA's ocular hazard standard using the preferred design. A design with a tilt angle of 25° and an orientation of 125° to the southeast was identified as being compliant. Like Site 1, this project also relies on solar panels constructed on carport structures that would permit continued use of the parking lot and provide a benefit of covered parking but would result in a higher installed cost due to the extra material associated with the support structures.

2 Airport Energy Usage and Solar PV Performance

A solar PV facility generates electricity which is fed into the existing electricity infrastructure network. The most cost-effective approach is to connect the solar system to a point in the electrical network that has existing capacity to accept the new power and avoid upgrades to the electrical network which would increase project costs. Airports can be good candidates for such an interconnection strategy because many are large consumers of electricity supported by existing electrical distribution lines that carry power from the electrical grid to serve the airport. Figure 2-1 shows the location of the existing electrical meters and associated distribution lines that connect the airport to the regional network. In addition to the electrical infrastructure shown, the utility service provider (We Energies) also owns and maintains electrical infrastructure off-airport which could be an option for interconnection. However, information on the capacity of that infrastructure and the potential to interconnect a solar facility to it was not made available for this study. Given the lack of information on the physical infrastructure and the uncertainty regarding energy policy associated with power purchase agreements, a direct connection to the We Energies system was not considered viable for the purpose of this analysis. Therefore, the analysis has focused on the known interconnection points on airport property.

Given the significant quantity of electricity consumed on airport property, one option considered is locating the solar PV electricity generation system on-site or "behind-the-meter" to serve the airport and decrease the amount of electricity that must be acquired from the grid. Such a design creates a bi-directional electricity pathway where the host consumes the electricity generated on-site but may also need to export electricity to the grid at times when there is a surplus and can also continue to purchase electricity from the grid when needed. This process is referred to as net energy metering as the electrical meter accounts for exported and imported electricity. Under federal law, the utility must allow an on-site generator to interconnect with the grid and export excess electricity back to the grid as long as the system and interconnection equipment is designed in accordance with international electric code standards to protect power quality and worker safety. While federal law requires the utility to accept the excess power, the amount the utility must pay for that power varies according to state law. State policies that encourage more on-site power generation compensate the host at a higher rate (e.g. retail) and those that discourage on-site generation return a lower rate (e.g. wholesale). Given the large amounts of electricity consumed on-site, airports are able to maximize the use of on-site generation and off-set the retail rate they pay the utility to purchase electricity from the grid, which can be a cost-effective option particularly where state policy limits the financial compensation from net metering.

To understand the potential value of solar PV electricity generated on-site and behind-the-meter, the amount of electricity consumed by the airport considering daily and seasonal patterns must be compared to the electricity generated by solar. This section reviews the airport's energy usage, forecasts the amount of electricity that would be generated by a solar project on-site for each of the preferred locations, and compares the usage and solar PV generation characteristics to estimate the value of the electricity and savings that the airport would achieve by consuming solar power and reducing electricity acquired from the grid.

2.1 Airport Energy Usage

As discussed in the Task 1 Report, the airport is served by the electrical grid with the electricity monitored at six meter locations. The network and the meter locations are shown on Figure 2-1. However, as shown in Figure 2-2, the majority of the electricity is provided to the Terminal Building (now served by meters A and B). Meters C through F lack the capacity to support and interconnect a solar PV project of 1 MW and therefore sites proximate to meters A and B are preferred to minimize project costs.

Meter	Name	Specs
A	Main Feeder 1	24.9kV
B	Main Feeder 2	24.9kV
C	Small Utility	
D	South Maintenance	480V
E	Firehouse	208V
F	Tunnel	480V

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Airport Terminal Buildings

Electric Meter Location

U_ELECTIRC WE Energies

U_ELECTRIC

0 1,600 3,200 Feet

General Mitchell International Airport
Milwaukee, Wisconsin

Figure 2-1
Existing Electrical Infrastructure

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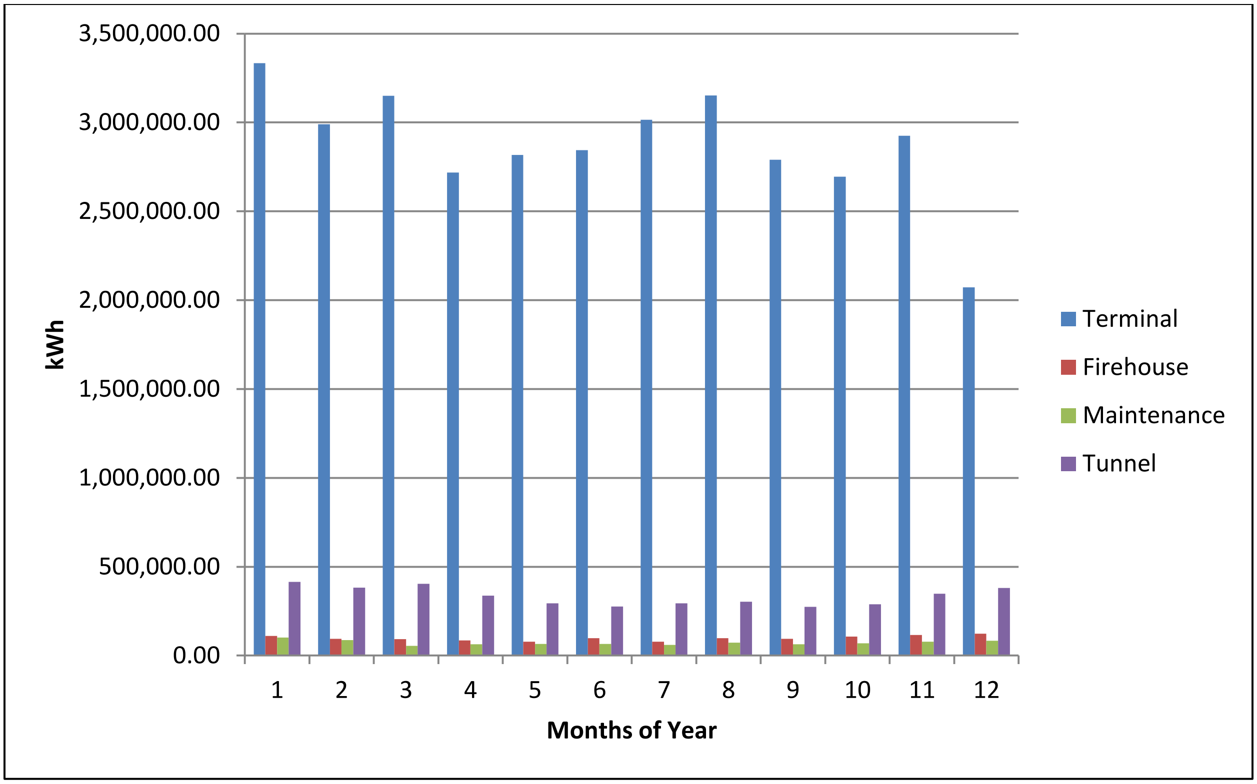

Figure 2-2. GMIA Electrical Meters and Energy Usage 2014

In December 2014, We Energies completed a new 24.9 kV circuit to the Terminal area to accommodate an increased electricity supply associated with future airport growth. The original circuit, noted as A on Figure 2-1, is located at the central heating plant. The new facility, noted as B and located adjacent to the parking garage, affords spare conduits which would allow a solar PV generating project to be interconnected to a 4.16 kV circuit behind GMIA's primary 24.9 kV revenue meters.

In January 2015, the new circuit was fully energized and We Energies began providing one electricity bill for each meter, referred to as Terminal-North and Terminal-South. To prepare a consistent level of analysis of energy usage at the Terminal, we have assessed electricity usage for calendar year 2014 when only the single bill was submitted (Account #-374) and circuit A was active.

Figures 2-3 and 2-4, generated from the We Energies customer energy management tool, show electricity usage (green line and right side access) compared with ambient temperature (blue line and left side axis) for the months of June and December. From the June graph, one can see how electricity usage tracks with ambient temperature where electricity usage increases are most likely the result of air conditioning and associated electricity required to run those systems during warmer ambient temperatures. In the December graph of energy use, you can see on December 5 when the power levels decrease which is an indication that the second circuit has been partially energized and the power is split between the two circuits.

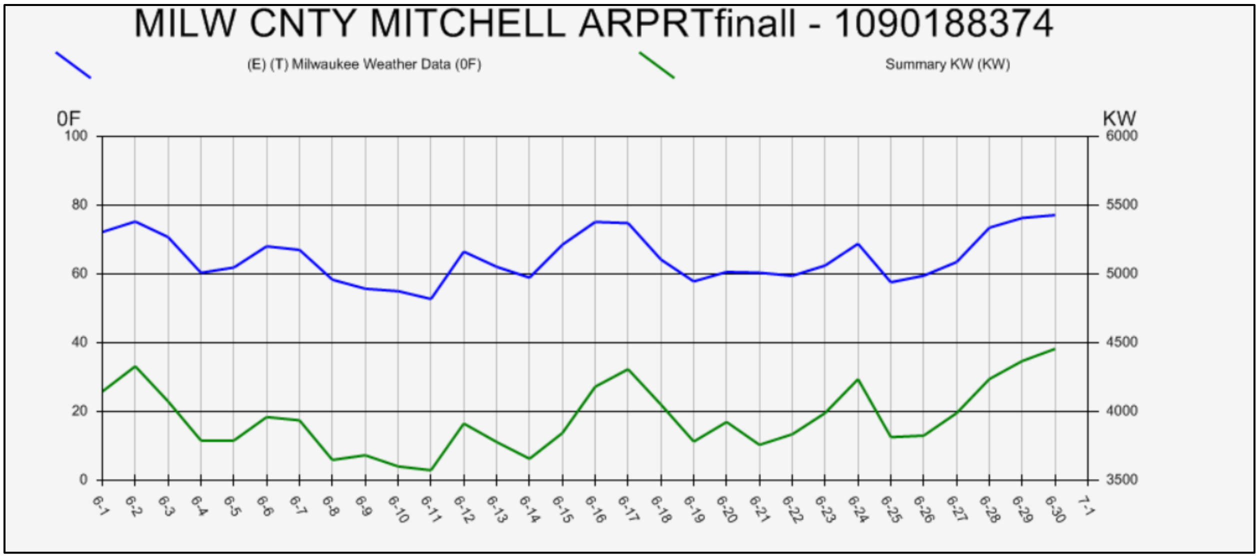

Figure 2-3. Ambient Temperature and Electricity Usage, Terminal Meter, June 2014

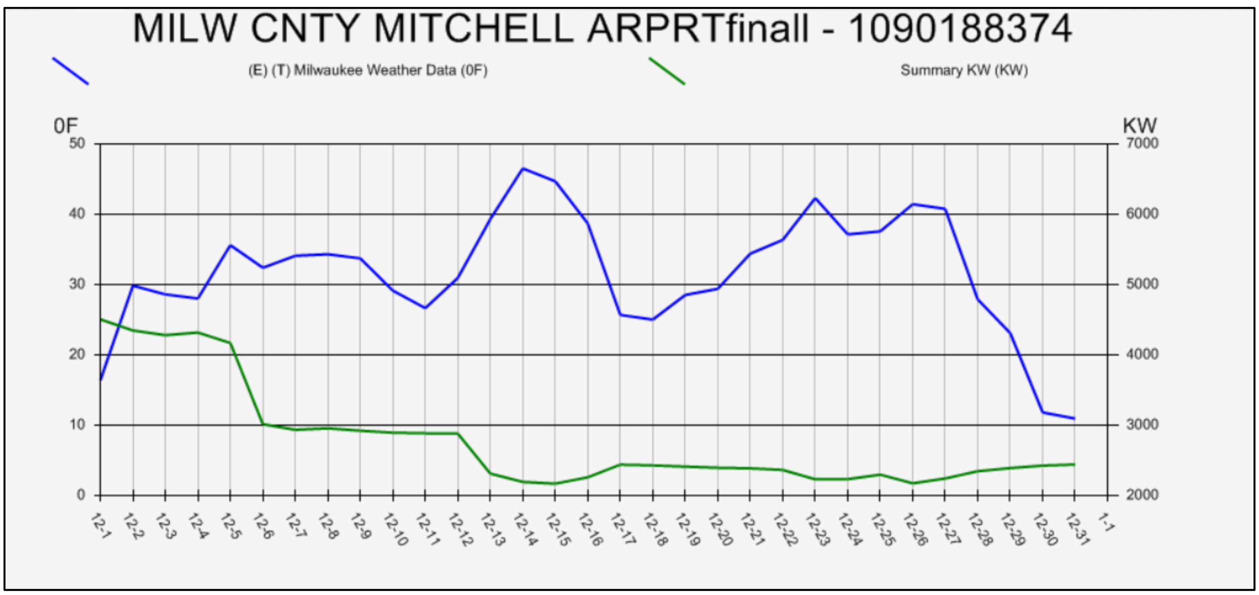

Figure 2-4. Ambient Temperature and Electricity Usage, Terminal Meter, December 2014

Figure 2-5 shows the monthly electricity consumption from the Terminal meter for on-peak (8am to 8pm) and off-peak (8pm to 8am). With higher power rates during peak hours, facilities like the airport terminal are incentivized to minimize use during daytime hours when energy demand is comparatively greater. Figure 2-5 also shows how the airport manages its electricity usage to maximize off-peak periods. The airport consumes close to half as much electricity during daytime hours as it does in the nighttime by taking advantage of daylighting and managing building temperatures early and late in the day. There are different seasonal patterns with overall electricity usage highest in the weather extremes of summer and winter. During summer, more electricity is required to power chillers for cooling. In winter, fans operate to distribute heat and lighting is on for longer periods due to shorter hours of natural sunlight.

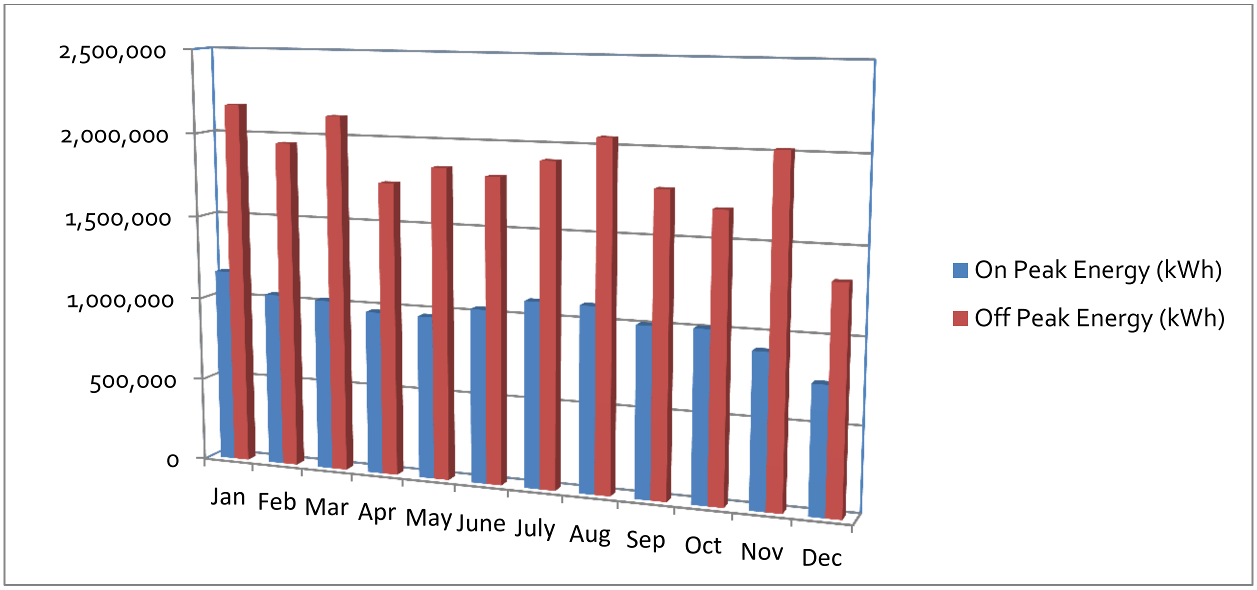

Figure 2-5. Monthly On-Peak and Off-Peak Electricity Usage, Terminal Meter, 2014

The airport receives bills from the utility for each meter on a monthly basis. The bills include costs for energy, which varies based on energy used and time of day (e.g., on-peak and off-peak), and fixed charges which cover all customers and include levies based on the amount of electricity required at any one time (called demand charges). Table 2-1 provides an example of the airport's bill for the Terminal Meter for June 2014.

Table 2-1. Components of Terminal Electricity Bill from We Energies (June 2014)

Type	Rate	Unit	Amount	Cost
Facilities Charge	$17.260270	Per day	30 days	$517.81
Demand Charge – On-Peak	$12.86100	Per kW	4,709.90 kW	$60,574.02
Demand Charge – Off-Peak	$1.30600	Per kW	5,752.30 kW	$7,512.50
Energy Charge – On-Peak	$0.07724	Per kWh	1,035,204 kWh	$79,959.16
Energy Charge – Off-Peak	$0.05279	Per kWh	1,808,603 kWh	$95,476.15
Fuel Cost Adjustment – On-Peak	-$0.00169	Per kWh	1,035,204 kWh	-$1,749.49
Fuel Cost Adjustment – Off-Peak	-$0.00127	Per kWh	1,808,603 kWh	-$2,296.93
Renewable Grant CR	-$0.000660	Per kWh	2,843,807 kWh	-$1,876.91
TOTAL				$238,116.31

It is important to understand how charges are applied in order to consider the implications of various ownership models discussed in Section 3 below because any alternative, including solar, must be compared with existing costs to determine the financial implications of future options. A brief description of each line item follows.

Facilities Charge – fixed charge to all customers on a per day basis. Rate varies by customer category (e.g., commercial, residential, etc.)

Demand Charge – this is a monthly charge based on the one time maximum amount of electricity required during the month. The charge is set at 93% of the peak usage. In the example above, the highest usage level during the on-peak period (8am to 8pm) was 5,064.41 kW and 93% of that peak is 4,709.90 kW. That amount is multiplied by the on-peak demand charge rate to calculate the monthly charge. While the value changes from month to month, the amount will be reflective of the type of customer and the maximum amount of electricity that the utility must be prepared to supply at any one time.

Energy Charge – this is calculated based on the amount of electricity used by the airport as measured at the meter. There is a higher on-peak rate and a lower off-peak rate to incentivize customers to limit electricity usage at peak times of day when the aggregate demand on the grid is highest. The on-peak period for the airport is defined as 8am to 8pm.

Fuel Cost Adjustment – the utility may incrementally increase or decrease electricity prices in response to market changes in cost of fuels (e.g. coal, oil, natural gas) through a fuel cost adjustment. When prices for these commodities rise, there is a cost per kWh charge; when prices drop, there is a cost per kWh credit. In the example above, fuel costs for June 2014 were lower than the base price set for electricity rates which represents a credit to the customer.

Renewable Grant Credit – We Energies received a grant under the American Recovery and Reinvestment Act to help fund the construction of the Rothschild Biomass Electricity Plant. As part of the conveyance of the grant, We Energies returns a credit to each customer’s bill which is represented in this line item.

2.2 Solar PV Production

2.2.1 PV Watts

The PVWatts Calculator is a web application developed by the National Renewable Energy Laboratory (NREL) to estimate the electricity production of a grid-connected roof- or ground-mounted PV system based on fundamental design inputs and project location that allow users to predict the performance of potential PV systems. To begin using the calculator, the user enters the address or geographic coordinates for a potential PV system. Based on the location, PVWatts accesses applicable solar resource data for the system which it translates into forecasted electricity generation. It uses hourly Typical Meteorological Year (TMY) weather data from the 239 weather stations across the U.S. To represent the system's physical characteristics, PVWatts requires a value for five inputs:

- The system's DC size,
- array type,
- a DC-to-AC derate factor,
- tilt angle, and
- azimuth angle.

Using an hour-by-hour simulation over a period of one year, PVWatts estimates the daily, monthly and annual electricity production of a PV system. It can also be used to assess the cost and value of the electricity produced by the system.

PVWatts is suitable for preliminary studies of potential locations for PV systems using typical crystalline silicon modules. It should be used as a screening tool to be followed up by 1) site-specific analysis once a project design is confirmed, 2) a particular solar module has been selected, and 3) project costs have been refined. For this report, PVWatts has been used for solar PV facility production estimates but not for the financial analysis as we sought to utilize more site-specific financial information.

2.2.2 Analysis of Project Sites

The top four solar PV sites were analyzed using PVWatts. The specifications for each site were input into the model and are presented in Table 2-2 along with the annual electricity generation predicted.

Table 2-2. Preferred Sites and Predicted Solar Electricity Generation

Project Site	Nameplate Capacity (kW dc)	Design (Orientation & Tilt)	Annual Generation (kWh)
Site 1 – Employee Parking	1,080	155° / 25°	1,405,998
Site 13 – Spur South	820	180° / 25°	1,080,152
Site 14 – Spur North	860	250° / 25°	1,012,182
Site 15 – Parking Garage	740	125° / 25°	915,473

Figure 2-6 shows the monthly generation for the four solar sites. As expected, electricity generation is maximized around the summer solstice and reaches a low point around the winter solstice. Peaks actually tend to occur in late spring before the panels get too hot which has a negative impact on system performance. The maximum amount of electricity produced is fundamentally a factor of the size of the array with the orientation affecting incrementally the efficiency of the production per unit area.

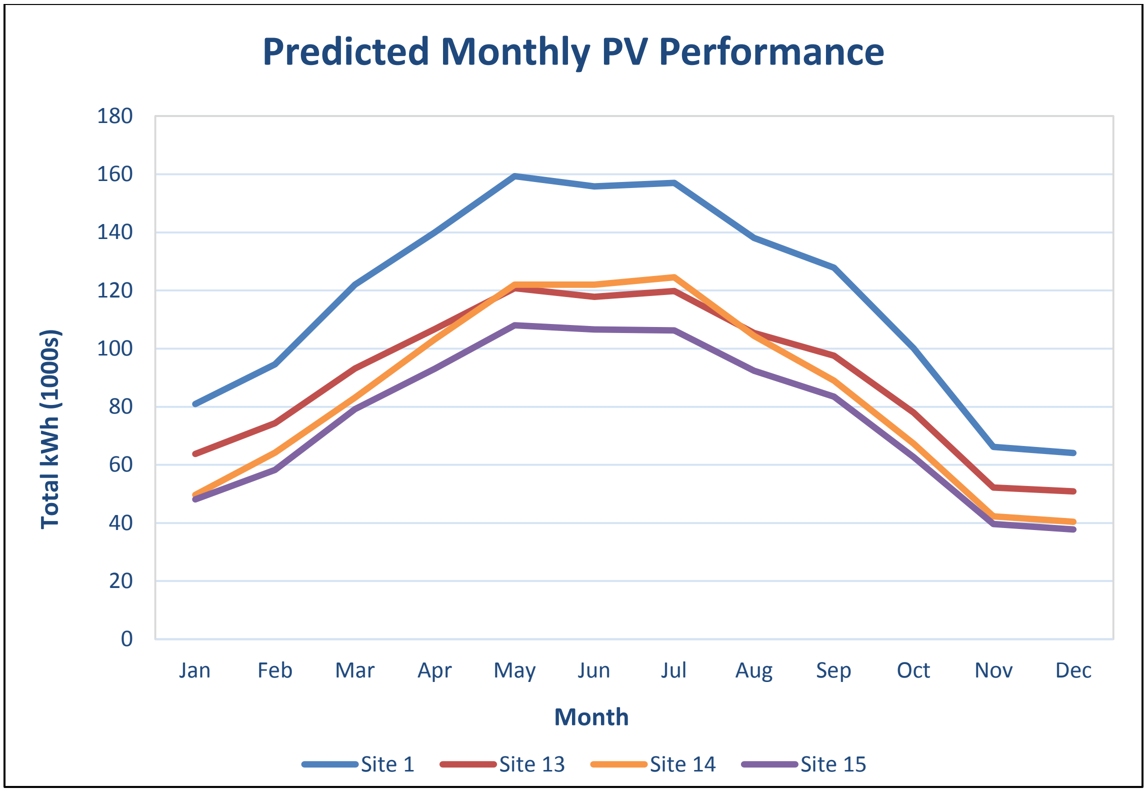

Figure 2-6. Predicted Monthly Performance of Preferred Solar PV Installation

Figure 2-7 shows the predicted hourly generation production for Site 1 on days that are representative of the four seasons of a year:

- Spring Equinox – March 21
- Summer Solstice – June 21
- Autumnal Equinox – September 21
- Winter Solstice – December 21

The pattern of hourly generation is very similar for the other three sites considered. Note that PVWatts does not factor in daylight savings time, so for example, an hour must be added to the times shown for the summer line plot (i.e. production begins around 5:00am and ceases around 8:00pm).

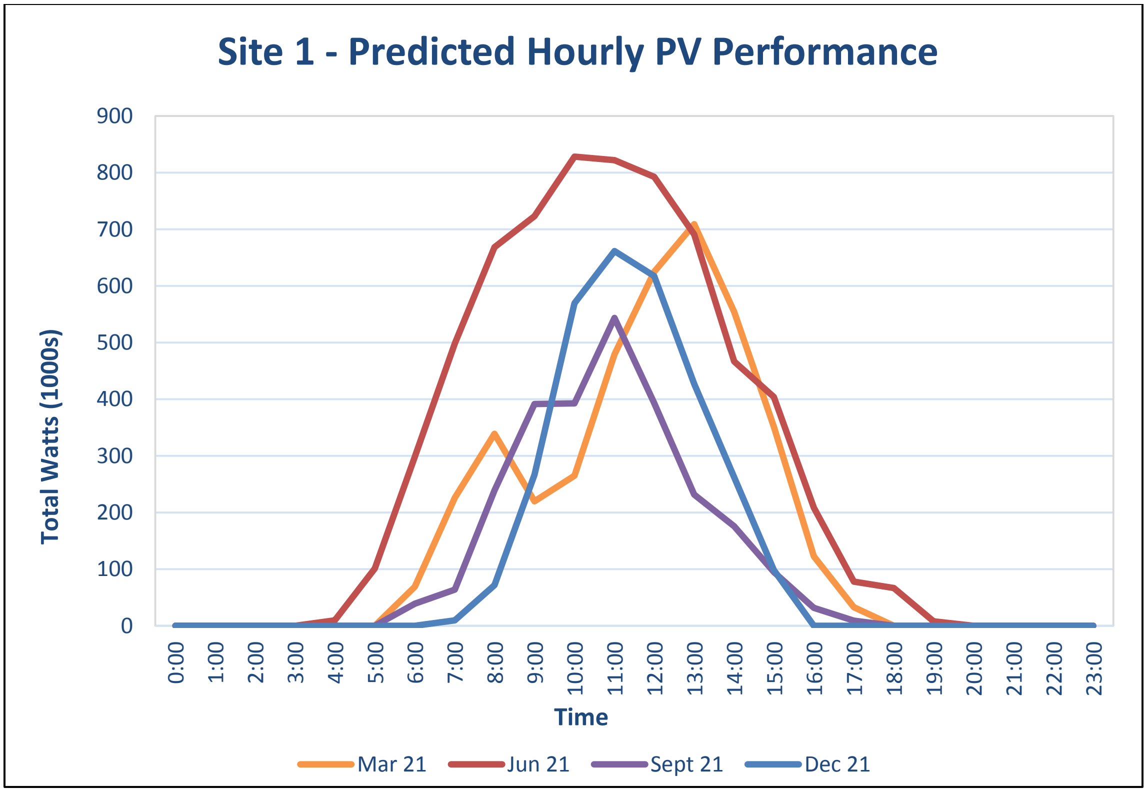

Figure 2-7. Predicted Hourly Performance from Site 1 During Seasonal Conditions

2.3 Solar PV Usage

2.3.1 Comparing kWh Generated and Produced

Solar power generated at GMIA would exit the PV facility and enter the Terminal's distribution circuits. The power would flow first to feed the terminal facilities that consume electricity. However, the system would be designed such that the power from the solar facility could flow back through the electrical meter and to the grid if there was not sufficient demand on site (behind-the-meter) to consume the electricity.

For every kWh of electricity from the solar facility that the terminal consumes, the airport does not have to purchase a kWh from the grid resulting in a decrease cost on the electricity bill. The cost savings from avoided electricity purchasing from the grid is one way that the airport can evaluate the financial benefit of the solar project. However, in order to calculate the cost savings of avoided electricity purchasing, one must compare the electricity usage at the terminal meter with the predicted electricity production from the potential solar PV facility and then confirm the value of that electricity based on the electricity bills and rates.

Figure 2-8 presents the hourly usage patterns from the Terminal meter in the four seasonal conditions and the solar electricity production from Site 1 for the same days to match solar PV production and terminal consumption. Expected solar generation is a maximum of 15% of energy demand, and therefore, no solar generation will be exported to the grid.

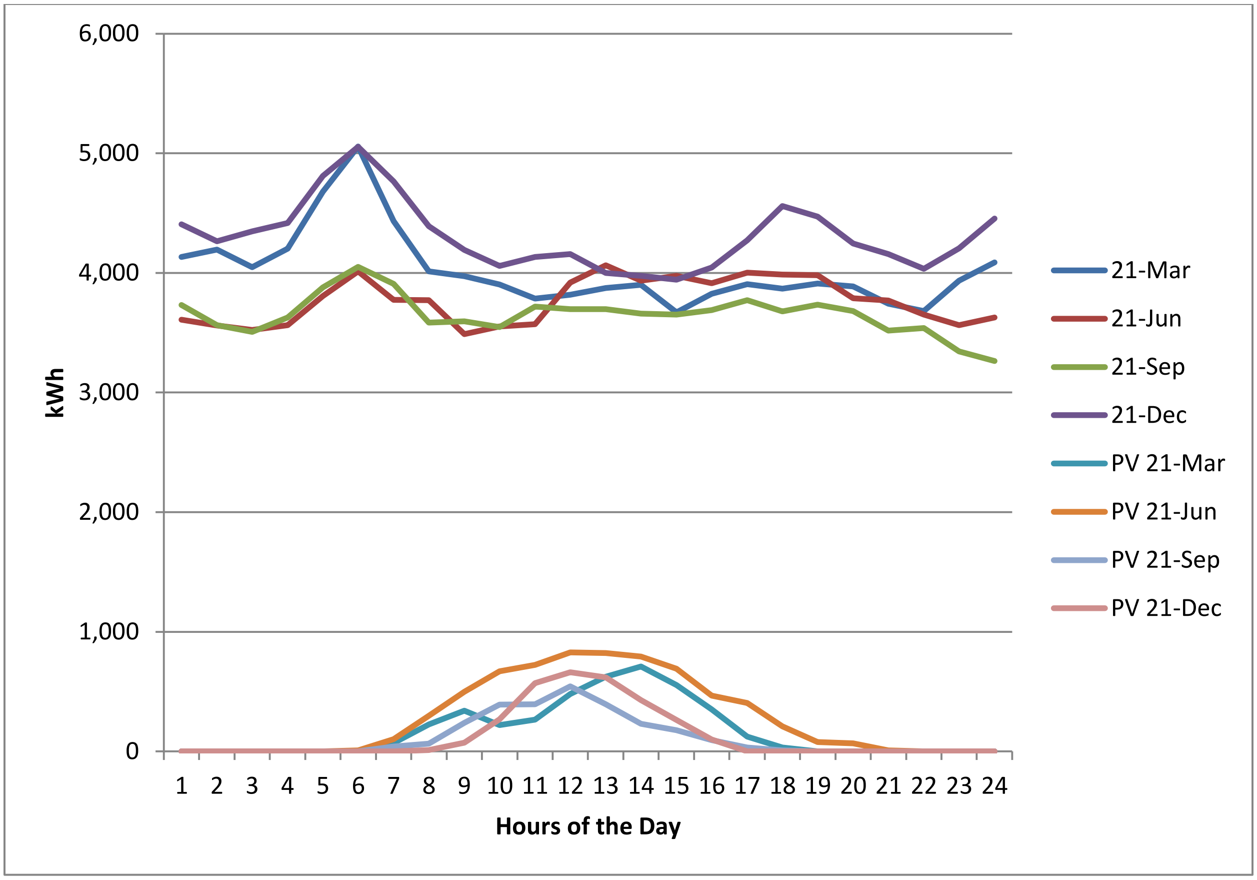

Figure 2-8. Solar PV Electricity Production from Site 1 compared with Terminal Consumption

The data shows that the solar PV facility sized at 1 MW nameplate produces a small enough percentage of the Terminal's electricity needs on an hourly basis such that it is reasonable to assume that all of the solar electricity will be consumed by the Terminal and represent avoided electricity otherwise purchased from the utility. In addition, it shows that the majority of the electricity will be produced during on-peak hour pricing and that the avoided cost is valued at the on-peak rate. It also shows that the terminal could potentially accommodate a larger amount of solar PV and increase the avoided cost of electricity otherwise purchased from the grid without crossing a threshold where the amount of solar power would be greater than the terminal's electricity demand requiring solar electricity to be exported to the grid. Even if the solar facility were exported to the grid using net metering, We Energies would compensate the airport for the same avoided cost rate. Some utilities in other states are required to compensate the customer for the favorable retail rate of electricity which includes facilities and demand charges but this is not the case in Wisconsin. While the size of net metered projects is capped in Wisconsin at 20 kW, this does not impact proposing a large project at the airport because all of the electricity generated can be consumed on-site. Expanding the size and generation capacity of the solar project could decrease the "per watt" installed cost which can be evaluated in the financial analysis of Section 3 below though the facility must be sized to ensure that generation does not exceed on-site consumption or the project would be inconsistent with the net metering project size cap. Figure 2-9 compares the off-peak and on-peak consumption amounts on a monthly basis with the amount expected to be generated by a 1 MW solar facility.

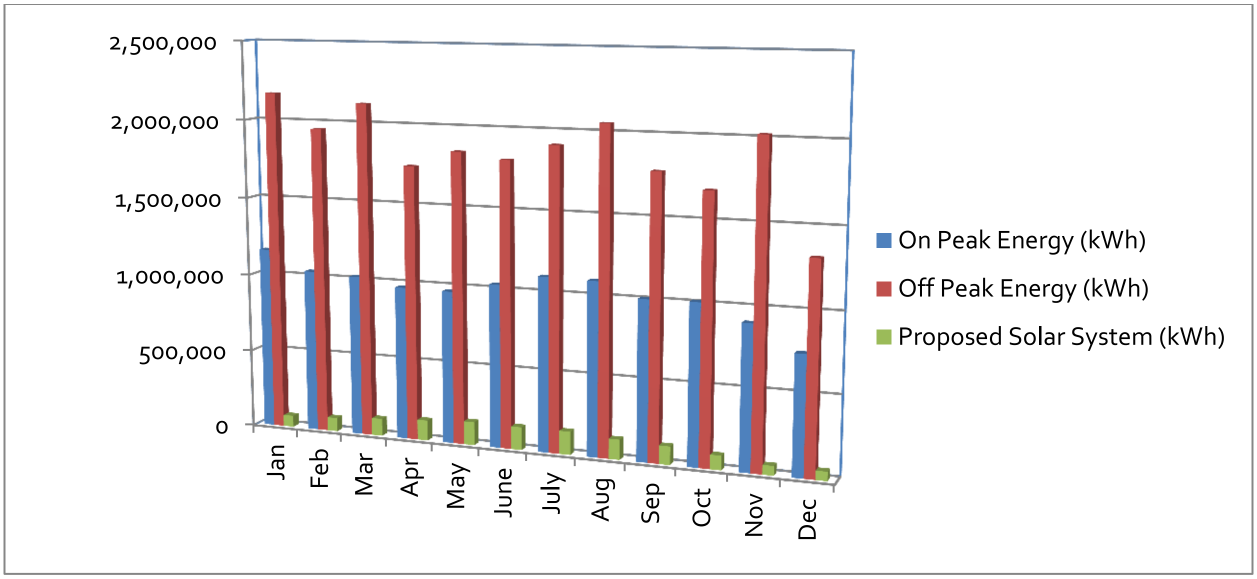

Figure 2-9. Monthly Electricity Usage and Amount Generated by 1 MW Solar Project

2.3.2 Valuing the Avoided Cost of Electricity

As described above, the solar PV facility will be generating electricity during daylight hours when there are suitable weather conditions. In summer, the PV system will generate electricity between 5am and 8pm. In winter, electricity generation will be limited to between 6am and 4pm. The airport's electric utility rate specifies that the on-peak hours are between 8am and 8pm and higher electricity rates are imposed for each kWh consumed. While some electricity will be generated outside of those time periods primarily on summer mornings, the majority of the electricity produced will offset power purchased from the utility at the on-peak energy rate. Calculating the value of the solar PV is accomplished by multiplying the amount of electricity predicted to be generated by the solar PV by the on-peak per kWh electricity rate of 7.7 ¢ / kWh. Table 2-3 presents the annual solar production predicted for each of the four preferred facilities and the value of the avoided cost based on the on-peak rate.

Table 2-3. Avoided cost value of Solar PV Electricity from Preferred Sites

SIte	Solar PV Electricity Produced Annually (kWh)	Value of Solar Electricity
1	1,405,998.38	$108,599.32
13	1,080,151.55	$83,430.91
14	1,012,181.75	$78,180.92
15	915,473.22	$70,711.15

It is also important to note that while the airport can maximize its financial benefit by generating electricity on-site during on-peak hours and reducing the amount of electricity purchased from the utility, there are many line items on the utility bill that are fixed and cannot be reduced. Table 2-4 lists the various types of charges from the utility bill that were described in Section 2.1 above and the how they are impacted by solar PV electric generation on-site and behind-the-meter.

Table 2-4. Utility Bill Charges and Implications of Solar PV Generation Project

Name	Description	Implications of Solar
Facility Charge	Daily charge assessed to all customers.	None. Charged to all customers regardless of electricity use patterns.
Demand Charge – On-Peak	Based on highest one time electricity use during on-peak.	None. Terminal will reach a typical demand charge level on any day when weather conditions prevent solar PV electricity generation.
Demand Charge – Off-Peak	Based on highest one time electricity use during off-peak.	None. Solar facility will not be operating during off-peak periods and will not affect how this charge is determined.
Energy Charge – On-Peak	The amount of electricity consumed during on-peak.	Yes. On-peak occurs from 8am to 8pm which overlaps with the time when the solar PV facility produces electricity.
Energy Charge – Off-Peak	The amount of electricity consumed during off-peak.	Not really. While a small amount of solar generation will occur during off-peak, it is marginal.
Fuel Cost Adjustment – On-Peak	An additional cost factor applied to on-peak electricity consumed.	Yes. On-peak occurs from 8am to 8pm which overlaps with the time when the solar PV facility produces electricity. However, this factor, whether a charge or credit, is small.
Fuel Cost Adjustment – Off-Peak	An additional cost factor applied to off-peak electricity consumed.	Not really. While a small amount of solar generation will occur during off-peak, it is marginal.
Renewable Grant CR	Credit to all customers.	None. Not impacted by whether a customer generates electricity on-site or not.

3 Project Ownership and Financing Options

The discussion in Section 2 provides context for valuing solar PV electricity in relation to the airport electricity bills and potential solar generation sites. However, there are a number of variables that must be considered when evaluating financing alternatives for a solar PV project and determining if a project at GMIA is financially feasible. Government legislation has developed public policy programs to incentivize solar and other renewable energy technologies due to their broad long-term technological, environmental and social benefits. Successful financing options are closely aligned with maximizing public policy incentives to reduce the cost and increase the value of solar electricity. Such programs are structured differently to benefit government and private owners.

This section provides an overview of the public policy programs that incentivize solar PV, the primary ownership arrangements, and how each capitalizes on the incentive programs. This description is followed by a financial analysis of the four preferred solar project sites identified at GMIA, and the financial options required to achieve an economical project.

3.1 Public Policy Context

There are federal and state regulatory and public policy programs that affect the financial viability of renewable energy projects. This section provides an overview of some of the key programs applicable to solar PV in Wisconsin.

3.1.1 Investment Tax Credit

Tax credits have been a fundamental public policy tool to incentivize many types of private sector activities that governments have sought to encourage. Congress approves tax credits for specific business sectors as part of budget authorizations and the Internal Revenue Service administers the programs and provides policy guidance on the implementation of programs. The Investment Tax Credit (ITC) applies a tax credit as a percentage of the investment value or cost to construct a solar power facility.

Authorization of tax credits by Congress has been unpredictable. It has allowed tax credit programs to expire and then be renewed for short-periods of time. This uncertainty has made it difficult for private investors to rely on the availability of the tax credits on a project-by-project basis producing inefficiencies. However, Congress extended the ITC for 8 years in 2008 which has provided a relatively stable platform for investors to work from. Unfortunately, the stable period will soon end when, after December 31, 2016, the tax credit will be reduced from 30% to 10%. Therefore, private developers are accelerating efforts to develop and put into service new solar facilities before the value of the tax credit is decreased.

Broad scale tax credits applicable for airport solar projects from state and local entities are rare though the interpretation of some tax laws like real estate taxes will likely have some impact on the financial costs of developing renewable energy. Solar projects constructed on-site are exempt by Wisconsin state law from property tax.

3.1.2 Wisconsin State Policies

3.1.2.1 Renewable Portfolio Standard and Renewable Energy Certificates

Renewable Portfolio Standards (RPS) are enacted by states to establish long-term renewable energy purchasing goals and mandate annual renewable energy purchase percentages by electric utility companies toward achieving those goals on an annual basis. While the design of state programs may vary, the essential idea of the RPS is the same. It requires electricity suppliers (or, alternatively, electricity generators or consumers) to source a certain quantity (in percentage, megawatt-hour, or megawatt terms) of renewable energy. The RPS creates a demand for renewable energy by necessitating its purchase or the utility must pay a penalty that is greater than any premium value for renewables established through a trading market. Many RPS programs track renewable energy purchasing through the ownership of renewable energy certificates (RECs).

A renewable energy facility produces two distinct products: electricity and environmental attributes. The electricity product is the same as any electricity generating system as sources of electricity are not distinguishable once they are fed into the electric grid and used by customers. The value of the electricity is set by the spot market and through purchase contracts with varying terms. The environmental attributes consist of benefits associated with avoiding emissions such as mercury and carbon dioxide (CO_2) that are produced from a conventional fossil fuel fired power plant. These environmental benefits can be packaged into a REC and sold separately from the electrical power. The REC is a way for regulatory entities to track buying and selling of renewable energy and credit the consumer of the green power. RECs are most often sold on a per megawatt hour (MWh) basis typically through a multi-year contract. The REC purchase is a paper transaction meaning that the buyer and seller of the RECs have no physical connection (e.g. a Tech company in California can buy RECs from a wind farm in the Midwest).

Airports that capitalize, construct, own and operate renewable energy facilities create RECs as the electricity is generated. The airport can hold and retire the REC and credibly claim that it uses green energy to power the airport. Or it can sell the REC to obtain additional revenue to help pay off its initial project investment with the buyer of the REC claiming the renewable energy purchase. The value of the REC will vary based on the REC market.

Buyers of RECs include utilities that are required by state policy to provide a specific percentage of the total electricity for consumption from a renewable source. REC buyers also include governments, private corporations, universities, hospitals and other organizations that have made public commitments to purchase renewable energy as part of their sustainability program. The list of the top consumers (both on-site generation and off-site REC purchases) of green power is listed on the U.S. Environmental Protection Agency's (EPA) Green Power Partnership website.

The Wisconsin Renewable Portfolio Standard (RPS) requires all Wisconsin electric providers to provide their retail electricity customers with a certain percentage of electricity from renewable resources. The RPS creates an overall statewide goal of 10% renewable electricity by 2015. Each Wisconsin electric provider has a unique RPS requirement, known as their renewable "baseline," based on how much renewable electricity the electric provider was providing in the years 2001-2003. Investor-owned utilities, municipal utilities and electric cooperatives are all obligated to comply with the RPS. We Energies has an RPS requirement of 8.27% in 2015. Wisconsin utilities have, as a group, met the 2015 RPS goal of 10% renewable energy. The majority of the demand has been satisfied by wind energy (64%), hydropower (19%) and biomass (16%). Solar contributes less than one percent of the RPS supply; thus the Wisconsin RPS does not drive solar power development. This is not uncommon as utilities in states with an RPS will acquire the most cost-effective renewable energy available which under recent market conditions has been wind energy. Certain states, such as Massachusetts and North Carolina, have established "buy solar" requirements on utilities which create a market drive specifically for solar.

3.1.2.2 Net Energy Metering

Net energy metering (or net metering) is a term that refers to an energy user's ability to generate on-site energy to supply its needs and export some excess energy back to the grid when it is not being used on-site. Under federal law, electric utilities must allow customer's the ability to net meter, although how much compensation the generator receives and the amount that can be exported back to the electric grid varies among state programs with some being comparatively lucrative to encourage on-site generation and the ability to net meter while others are designed to discourage net metering.

Net metering programs that are favorable to on-site generation will compensate generators at the retail electricity rate (as opposed to the wholesale or avoided cost rate) allowing them to reduce their net costs by a third to a half depending on the rate structure. They may also allow an on-site system to supply a greater percentage of power compared to the on-site demand allowing for greater revenues. Utility programs that seek to limit net metering capacity and compensate at the wholesale rate argue with some justification that the export of excess electricity is utilizing the grid without paying for entry (i.e. distribution costs which is the majority of the difference between wholesale and retail prices) and thus should pay only the wholesale rate. State programs may also limit the amount of net metered energy through project size caps and total caps.

Wisconsin net energy metering programs tend to discourage the practice. We Energies provides compensation for the avoided cost of electricity which does not include facilities and demand charges. It like other utilities argues with reason that customers who generate power on-site continue to rely on the grid for electricity supply at times and therefore must contribute to maintaining the system. Wisconsin state policy further limits net metering by capping the size of an individual net metered system at 20 kW. While federal law requires utilities to accept power from larger installations, any compensation above the computed 20 kW generation threshold may have no value to the generator. It is important to note that the net metering cap does not necessarily affect large energy consumers from building generation projects with greater capacity than 20 kW behind the meter when they consume all of the power on-site.

3.2 Ownership

There are two primary ownership options that are applicable to a solar project at GMIA: airport-owned and third party-owned. The airport-owned scenario utilizes financing options and tools available to tax exempt government entities including bonds and grants. The third party-owned scenario enables a private taxable entity to own the solar PV system on airport land through a lease agreement and monetize the investment tax credit (ITC) to reduce the cost of the solar PV electricity generated. The baseline for evaluating each case is the existing condition where the airport purchases electricity from the utility drawing on the grid as demand warrants and the utility sends the airport a monthly bill for the electricity it uses based on an accounting at the utility's electrical meter and fixed charges. This section describes each scenario and presents a financial analysis for solar PV projects at GMIA.

3.2.1 Airport-Owned

In the airport-owned scenario, the airport funds, constructs, owns and operates the solar power facility. The facility generates electricity on-site, behind-the-meter and directly feeds electricity consumption at the airport. At times when the system generates more electricity than the building can consume, the excess electricity is sold back to the utility. At times when the building consumes more electricity than the system can produce, the airport purchases the required electricity from the utility. The meter records the amount of electricity drawn from the grid and credits back excess electricity sold to the utility. The amount of electricity that can be sold and the value of that electricity (e.g., wholesale or retail rate) vary among states. However, the difference between what is bought and sold is the airport's electricity bill (which could be a liability or an asset).

The airport invests in the facility and recoups its investment through savings in energy bills due to the value of solar PV electricity. Benefits are accrued over time through the value of avoided cost that would otherwise be paid through purchasing electricity from the utility. The savings can be added over time to determine the time required to pay back the investment in the system. As owner of the solar facility, the airport would also create renewable energy certificates (RECs), which is a tradable commodity and may provide the airport additional revenue to improve system payback.

3.2.1.1 Overview and Roles

For both direct ownership and third party ownership, the solar project development requires the same expertise but the roles and responsibilities are different.

In the airport-owned scenario, the airport will own the system and execute contracts with various entities to ensure that it is designed, constructed, and operated properly. As owner, the airport assumes greater risk for the successful performance of the facility and mitigates that risk through contracts with companies who have demonstrated expertise in the engineering, construction, and operations of solar facilities. Along with the heighten risk, the airport also seeks to take advantage of the long-term benefits of ownership including the condition that once the facility is paid off, it will produce nearly free electricity in accordance with the solar panel manufacturer's performance warranty through year 25 with limited operations and maintenance expense. The airport may also save money on long-term system management by developing technical skills in-house rather than contracting for services.

The airport will work with its on-call engineer to specify a logical and reasonably cost-effective location to site a solar PV facility considering physical, environmental, and regulatory constraints, and a suitable location to interconnect to the existing electrical infrastructure. It will select a solar energy company through a public procurement process to engineer, procure, and construct the solar PV facility in accordance with a bid specifications prepared by the airport and its on-call consultant team. The solar energy company will commission the system and obtain approval to operate from the utility. Then a contract will be executed with the solar energy company and/or affiliated partners and engineers to guide operations and maintenance to ensure that the facility performs as expected and maximizes its electricity production value.

3.2.1.2 Airport Financing Options

The financing options available to the airport includes those that are traditionally available to airports as well as those that are available to government entities who seek to develop renewable energy projects. Based on analysis of the potential funding sources, the following options were found to be the most probable for use by GMIA.

- **CREB (Clean Renewable Energy Bond)** – Qualified tax credit bonds authorized by the Energy Tax Incentive Act of 2005, and allocated under Section 54c of the Internal Revenue Code which allows projects to be financed and the federal government pays the interest after project completion. The amount of funding available through CREBs changes annually, based on congressional allocation. The IRS has estimated that approximately $1.4 billion are available for the second half of 2015. These funds require the approved project sponsor to issue bonds for the project. Discussion with County staff determined that GMIA would not qualify for these bonds because it has been the County's policy to issue only general airport revenue bonds (GARBs) for the airport. Still, this financing option has been evaluated in case policy changes.
- **QECB (Qualified Energy Conservation Bond)** – Qualified tax credit bonds that enable state or local governments to borrow money at attractive rates to fund energy conservation projects. Bonds are subsidized by the U.S Treasury which provides a credit of 70 percent of the full allowable interest rate. Funding through QECBs is dependent on congressional allocation, and can change annually. Congress allocated $3.2 billion for 2015. The County has received approval to issue up to $5.5 Million for 2015 to purchase transit buses and plans to request authorization up to another $7.3 Million this fall. Discussion with County staff determined that GMIA would not qualify for these bonds because it has been the County's policy to issue only general airport revenue bonds (GARBs) for the airport. Still, this financing option has been evaluated in case policy changes.
- **U.S Department of Energy (DOE) Loan Guarantee Program** – Primarily for utility scale projects, the DOE Guarantees the debt of privately held energy generation and manufacturing projects, guaranteeing to a private lender that if the company defaults, the government will step in to repay outstanding balance. The Loan Guarantee Program was created in 2005 to overcome funding challenges for large projects (manufacturing and generating) as new technologies transition from the research and development stage to full commercial

deployment. This program has been used to fund Tesla Motors and Fisker manufacturing plants, solar wafer and panel manufacturers, as well as nuclear and wind projects. This program is not applicable to GMIA based on scale of the proposed project which is below the DOE program thresholds.

- **AIP Funds –** Projects eligible to receive funding under AIP generally include those that enhance airport safety, capacity, security and environmental concerns. Several types of AIP grants are available. Each type requires the Airport to contribute local funds to match a portion of the federal contribution. For GMIA, as a medium hub airport, the federal share is 75% of the project expense.
    - **Energy Grants -** The Voluntary Airport Low Emission Program (VALE) is designed to reduce all sources of airport ground emissions, and is a set-aside in the AIP. Through 2011, VALE was available to airports to fund solar projects and a handful of airport-owned facilities were built. However, as part of the FAA Modernization and Reform Act of 2012, the FAA was authorized under Section 512 to fund energy efficiency and renewable energy projects. While a few solar and geothermal projects have received funding under the program, the FAA has not yet released formal guidance on how airports can apply for the funds, and it is not being allocated as an AIP set-aside which means airport energy projects must compete for funding with more traditional AIP funded projects. One important perquisite to funding is that the airport performs an energy audit on buildings that would receive energy improvements.
    - **AIP Entitlement Grant Funds** – AIP Entitlement Funds are awarded by the FAA and apportioned based on enplanements and PFC authorizations. These are generally required to be used on projects with the highest priorities to support airport operations, safety and security.
    - **AIP Discretionary Grant Funds** – AIP Discretionary Funds are grants awarded by the FAA. Distribution is based on projects that best carry out the purpose of the AIP with highest priority given to safety, security, reconstruction, capacity and standards. Airports compete against projects in the same FAA region for funds.
- **PFCs** – PFCs are funds collected by the airlines on passenger tickets as part of the use of the airport. Funds are committed to project that have been approved through a consultation with the airlines and public comment. Typically, PFCs are used to pay debt service and financing costs associated with bond issues. PFCs can be combined with federal grant funds or can meet the non-federal share of AIP-funded projects. Projects funded with PFCs must preserve or enhance safety, security or capacity of the national air transportation system; reduce noise or mitigate noise impacts resulting from an airport; or present opportunities to enhance competition between or among carriers. Medium and large hub airports that impose PFCs face a reduction in their AIP apportionment funds. MKE has had a PFC program in place since 1995, and the current authorization runs through 2027 with a collection rate of $4.50 per enplanement, which is the maximum allowable under current law. In 2013, collections totaled over $13 Million (of which $7.2 Million was pledged for PFC-eligible debt service) while PFC expenditures totaled over $16 Million, requiring the Airport to use its PFC reserves. At the end of 2013, the unspent reserves totaled over $20 Million. A portion of the PFC program has been used to finance General Airport Revenue Bonds (GARBs) for PFC-eligible projects, while the other half has been used on a pay-as-you-go basis; that is, using the revenues as they are received. The Airport's master plan proposed continued use of PFCs through 2021.
- **General Airport Revenue Bonds –** the Airport could issue GARBs for a solar project much like a GARB issuance for any capital project. Payback could be funded with PFCs or Airport

Development Funds, or with savings from the reduced cost of power. Depending on the airline agreement structure, the bonds may require approval by the airlines. Typically a small project such as this one would be combined with other projects to increase the size of issuance for economy of overhead costs. The Master Plan recommended applying other equity sources first before utilizing debt funds. It proposed issuance of $1.3 billion to meet remaining funding requirements for projects identified in the study's 20-year CIP.

- **Focus on Energy Grants** – Focus on Energy is Wisconsin's statewide energy-efficiency and renewable-resource program, which is funded by the state's investor-owned energy utilities as required under Wisconsin law. The Public Service Commission of Wisconsin (PSC) provides oversight of Focus on Energy which works with eligible Wisconsin residents and businesses to install cost-effective energy efficiency and renewable-energy projects. CB&I (Chicago Bridge & Iron Company, formerly Shaw Environmental & Infrastructure, Inc.) is contracted to serve as the Program Administrator and is responsible for designing all of Focus on Energy's programs and the overall performance of these programs in meeting Wisconsin's energy-savings goals. The Renewable Energy Competitive Incentive Program (RECIP) provides incentives for cost-effective renewable energy systems installed at eligible Wisconsin organizations through a competitive request for proposals (RFP) process. The RECIP provides awards grants of $500,000 or up to 50% of the total project cost. In the spring of 2015, $3.8 Million dollar in grants was awarded for 91 projects of which 85% of the grants went to solar PV projects. The airport would be eligible for a $500,000 grant.

3.2.1.3 Airport's Capital Program

The Airport's five-year Capital Improvement Program (CIP) outlines the planned development projects through 2020 and reflects the Airport's operational priorities. Through 2020 the airport has 39 projects on their CIP for both GMIA and Lawrence J Timmerman Airport, the county's general aviation airport. Funding for these projects is expected to be a mix of AIP, PFC, state grants, airport development funds (ADF), and bonds totaling $146 Million. Table 3-1 lists the airport's projects by funding area and fiscal year. Table 3-2 presents the various funding mechanisms and how they are allocated annually.

Based on discussions with the airport finance staff, the airport's entitlements and discretionary funds are fully accounted for during this period. As noted previously, the Airport has airline approval for issuance of up to $59 Million in GARBs through 2016 that would be factored into the airlines' rates and charges. Of that, $9 Million remains to be allocated, and the County is negotiating for extension of the bond use approval through 2020. The remainder of the CIP is to be funded from other sources. Use of these bonds to fund a solar project would most likely require airline approval. If the project were funded under this bond authority, it would be grouped with other projects to increase the total issuance. If the project were funded under other sources, the cost – and probably the savings due to decreased energy costs – could not be passed on to the airlines.

Table 3-1. CIP Allocations by Airport Area

Airport Area	2016	2017	2018	2019	2020	Totals
Landside and Noise Projects	$6,608	$3,056	$6,055	$1,921	$0	$17,640
Airfield Projects	$7,546	$19,381	$14,438	$11,006	$3,620	$55,991
Terminal Projects	$3,600	$6,800	$25,000	$26,500	$0	$61,900
General Aviation (LJT Airport)	$2,150	$2,250	$425	$425	$225	$5,475
Equipment and Other Projects	$400	$0	$1,000	$0	$4,000	$5,400
All Projects	**$20,304**	**$31,487**	**$46,918**	**$39,852**	**$7,845**	**$146,406**

Source: Derived from MKE 5YR CIP 2016-2020. All figures are thousands of dollars.

Table 3-2. CIP Allocations by Funding Source

All Projects (000's)	2016	2017	2018	2019	2020	Totals
AIP - Entitlements (some projects are multi-year)	$1,711	$1,678	$2,540	$2,590	$1,765	$10,284
AIP - Discretionary	$3,710	$3,621	$4,539	$5,665	$950	$18,485
Airport Noise Discretionary	$0	$2,153	$4,843	$795	$0	$7,791
State Grants	$707	$6,899	$1,807	$1,497	$464	$11,373
Pay-As-You-Go PFCs	$609	$2,759	$11,536	$6,725	$4,453	$26,082
PFC-Backed Bonds	$0	$8,900	$10,000	$10,000	$0	$28,900
Airport Development Funds	$1,800	$5,050	$11,250	$11,250	$0	$29,350
ADF - Depreciated	$0	$0	$0	$0	$0	$0
Capital Improvement Reserve Account (CIRA)	$2,412	$23	$21	$947	$11	$3,414
General Airport Revenue Bonds (GARBs)	$7,600	$0	$0	$0	$0	$7,600
Other Airport Funds	$0	$0	$0	$0	$0	$0
GA - Entitlement Grants	$1,755	$405	$383	$383	$203	$3,128
Totals	**$20,304**	**$31,487**	**$46,918**	**$39,852**	**$7,845**	**$146,406**

Source: Derived from MKE 5YR CIP 2016-2020 All figures are thousands of dollars.

3.2.1.4 Financial Analysis

A financial analysis has been prepared to evaluate the cost of an airport-owned solar project at GMIA. The analysis relies on available information associated with project concepts and is meant to be a first cut at assessing the financial feasibility to provide an overall indication of cost-effectiveness and not an exact accounting of project cost and benefit. The data rely on industry standards that aggregate many cost factors all of which can be variable. Yet, the base cost and revenue numbers are grounded in information relevant to GMIA and its geographic location.

The analysis is focused on four preferred solar project sites and six different potential funding options for each site. The potential costs and savings from each project site is utilized including specific information about the amount of electricity that will be generated at each site as predicted by PVWatts based on the size and design, installation costs, operations and maintenance costs, and savings that can be expected from the avoided cost of purchasing electricity from the utility. The installation costs vary depending on where the project would be located and type of design (e.g., ground mount or carport. Table 3-3 provides the key project cost assumptions that have been used in the financial modeling.

Table 3-3. Key Project Cost Assumptions

Item	Value	Source
Installed Cost – Ground-mount	$2.60/watt	PV Watts
Installed Cost – Carport	$3.80/watt	Comparable Public Project
Value of Electricity	7.7¢ /kWh	Airport's current On-Peak
Annual Electricity Price Increase	3.5%	Focus on Energy
Annual O&M Cost	1% of installed cost	NREL
Useful Life of Project	25 years	Standard panel warranty
Annual degradation factor for panel production	0.5%	Standard panel warranty

The installed cost includes all soft costs associated with project development including financing fees, reserves, permitting and design, and transaction costs.

The results are provided in Tables 3-4 through 3-7 for Sites 1, 13, 14, and 15, respectively. Each table includes the Annual Debt Service, Anticipated Annual Cost Savings/Revenue and Net Annual Revenue (Cost). The annual cost savings/revenue is assumed to be equal to the sale of power generated by the facility. Both the CREB and QECB programs allow for complete initial funding for the project while AIP funding is limited to 75% of the project cost.

Factors that affect the results among the four sites include installation cost (ground-mount vs. carport), availability of grant funding (AIP and Focus on Energy), project size/design, and the amount of cost savings accrued through off-set electricity. The net annual revenue cost based on a 25 year project life is a value of cost-effectiveness of the project and funding program.

While the airport would own renewable energy credits (RECs) produced by the project, RECs do not have a market value in Wisconsin because utility companies are purchasing lower cost wind and biomass to meet their REC obligation. We assume that the airport would retain and retire the RECs as part of their sustainability program. Voluntary RECs buyers could include organizations like universities and hospitals whose constituents require that the institution meet environmental and social goals.

The financial analysis demonstrates that the most economical option for any of the four project sites is to utilize Airport Improvement Program funds because the FAA grant would cover 75% of the project cost.

Table 3-4. Financial Analysis of Site 1

Capital Cost	Eligible Funding Sources	Funding Amount	Airport Funded Cost	Annual Principal/Sinking Fund Payments	Annual Debt Service	Annual O&M Cost	Anticipated Annual Cost Savings/Revenue	Net Annual Revenue/(Cost)
$3,800,000	Clean Renewable Energy Bonds (CREBs)	$3,955,800[1]	$5,855,192[5]	$197,790	$47,470[3]	$38,000[4]	$108,262	($174,998)
$3,800,000	Qualified Energy Conservation Bonds (QECBs)	$3,955,800[1]	$5,855,192[5]	$197,790	$47,470[3]	$38,000[4]	$108,262	($174,998)
$3,800,000	AIP Entitlement Funds	$2,850,000[2]	$950,000[1]	N/A	$0	$38,000[4]	$108,262	$70,262
$3,800,000	AIP Discretionary Funds	$2,850,000[2]	$950,000[1]	N/A	$0	$38,000[4]	$108,262	$70,262
$3,800,000	General Airport Revenue Bonds	$4,064,064	$6,343,886[7]	$203,203	$66,491[6]	$38,000[4]	$108,262	($199,432)
$3,800,000	CREBs with $500,000 Focus on Energy Grant	$3,455,800	$5,235,192	$172,790	$41,470	$38,000	$108,262	($143,998)

Notes and Sources:
1. Project Capital Cost and 4.1% Bond Issuance Cost
2. MKE is a Medium Hub Airport AIP funds can only cover 75% of the project cost. Airport must match the remaining 25% of project cost
3. Debt service of Airport Funded Cost; assumes 4% interest rate, 20 year term and 2.8% Direct Subsidy (70% Tax Credit Rate)
4. Based on FAA guidance of 1% of capital cost
5. Both the CREBs and QECBs airport assumed cost include the 4.1% Bond Issuance Cost, accumulated bond coupon payments and annual O&M Costs
6. Average Annual debt service GARB; assumes 4% interest rate amortized over 20 year term.
7. Airport assumed cost include the 4.1% Bond Issuance Cost, accumulated bond coupon payments, annual O&M Costs and capitalized interest (year one)
Assume 25-year life of the facility
All in 2015 costs

Table 3-5. Financial Analysis of Site 13

Capital Cost	Eligible Funding Sources	Funding Amount	Airport Funded Cost	Annual Principal/Sinking Fund Payments	Annual Debt Service	Annual O&M Cost	Anticipated Annual Cost Savings/Revenue	Net Annual Revenue/(Cost)
$2,600,000	Clean Renewable Energy Bonds (CREBs)	$2,706,600[1]	$4,006,184[5]	$135,330	$32,479[3]	$26,000[4]	$83,172	($110,637)
$2,600,000	Qualified Energy Conservation Bonds (QECBs)	$2,706,600[1]	$4,006,184[5]	$135,330	$32,479[3]	$26,000[4]	$83,172	($110,637)
$2,600,000	AIP Entitlement Funds	$1,950,000[2]	$650,000[1]	N/A	$0	$26,000[4]	$83,172	$57,172
$2,600,000	AIP Discretionary Funds	$1,950,000[2]	$650,000[1]	N/A	$0	$26,000[4]	$83,172	$57,172
$2,600,000	General Airport Revenue Bonds	$2,814,864	$4,794,686[7]	$140,743	$66,491[6]	$26,000[4]	$83,172	($150,063)
$2,600,000	CREBs with $500,000 Focus on Energy Grant	$2,206,600	$3,386,184	$110,330	$26,479	$26,000	$83,172	($79,637)

Notes and Sources:
1. Project Capital Cost and 4.1% Bond Issuance Cost
2. MKE is a Medium Hub Airport AIP funds can only cover 75% of the project cost. Airport must match the remaining 25% of project cost
3. Debt service of Airport Funded Cost; assumes 4% interest rate, 20 year term and 2.8% Direct Subsidy (70% Tax Credit Rate)
4. Based on FAA guidance of 1% of capital cost
5. Both the CREBs and QECBs airport assumed cost include the 4.1% Bond Issuance Cost, accumulated bond coupon payments and annual O&M Costs
6. Average Annual debt service GARB; assumes 4% interest rate amortized over 20 year term.
7. Airport assumed cost include the 4.1% Bond Issuance Cost, accumulated bond coupon payments, annual O&M Costs and capitalized interest(year one)
Assume 25-year life of the facility
All in 2015 costs

Table 3-6. Financial Analysis of Site 14

Capital Cost	Eligible Funding Sources	Funding Amount	Airport Funded Cost	Annual Principal/Sinking Fund Payments	Annual Debt Service	Annual O&M Cost	Anticipated Annual Cost Savings/Revenue	Net Annual Revenue/(Cost)
$2,600,000	Clean Renewable Energy Bonds (CREBs)	$2,706,600[1]	$4,006,184[5]	$135,330	$32,479[3]	$26,000[4]	$77,938	($115,871)
$2,600,000	Qualified Energy Conservation Bonds (QECBs)	$2,706,600[1]	$4,006,184[5]	$135,330	$32,479[3]	$26,000[4]	$77,938	($115,871)
$2,600,000	AIP Entitlement Funds	$1,950,000[2]	$650,000[1]	N/A	$0	$26,000[4]	$77,938	$51,938
$2,600,000	AIP Discretionary Funds	$1,950,000[2]	$650,000[1]	N/A	$0	$26,000[4]	$77,938	$51,938
$2,600,000	General Airport Revenue Bonds	$2,814,864	$4,794,686[7]	$140,743	$66,491[6]	$26,000[4]	$77,938	($155,296)
$2,600,000	CREBs with $500,000 Focus on Energy Grant	$2,206,600	$3,386,184	$110,330	$26,479	$26,000	$77,938	($84,871)

Notes and Sources:
1. Project Capital Cost and 4.1% Bond Issuance Cost
2. MKE is a Medium Hub Airport AIP funds can only cover 75% of the project cost. Airport must match the remaining 25% of project cost
3. Debt service of Airport Funded Cost; assumes 4% interest rate, 20 year term and 2.8% Direct Subsidy (70% Tax Credit Rate)
4. Based on FAA guidance of 1% of capital cost
5. Both the CREBs and QECBs airport assumed cost include the 4.1% Bond Issuance Cost, accumulated bond coupon payments and annual O&M Costs
6. Average Annual debt service GARB; assumes 4% interest rate amortized over 20 year term.
7. Airport assumed cost include the 4.1% Bond Issuance Cost, accumulated bond coupon payments, annual O&M Costs and capitalized interest(year one)
Assume 25-year life of the facility
All in 2015 costs

Table 3-7. Financial Analysis of Site 15

Capital Cost	Eligible Funding Sources	Funding Amount	Airport Funded Cost	Annual Principal/Sinking Fund Payments	Annual Debt Service	Annual O&M Cost	Anticipated Annual Cost Savings/Revenue	Net Annual Revenue/(Cost)
$3,800,000	Clean Renewable Energy Bonds (CREBs)	$3,955,800[1]	$5,855,192[5]	$197,790	$47,470[3]	$38,000[4]	$70,491	($212,768)
$3,800,000	Qualified Energy Conservation Bonds (QECBs)	$3,955,800[1]	$5,855,192[5]	$197,790	$47,470[3]	$38,000[4]	$70,491	($212,768)
$3,800,000	AIP Entitlement Funds	$2,850,000[2]	$950,000[1]	N/A	$0	$38,000[4]	$70,491	$32,491
$3,800,000	AIP Discretionary Funds	$2,850,000[2]	$950,000[1]	N/A	$0	$38,000[4]	$70,491	$32,491
$3,800,000	General Airport Revenue Bonds	$4,064,064	$6,343,886[7]	$203,203	$66,491[6]	$38,000[4]	$70,491	($237,203)
$3,800,000	CREBs with $500,000 grant from Focus on Energy	$3,455,800	$5,235,192	$172,790	$41,470	$38,000	$70,491	($181,768)

Notes and Sources:
1. Project Capital Cost and 4.1% Bond Issuance Cost
2. MKE is a Medium Hub Airport AIP funds can only cover 75% of the project cost. Airport must match the remaining 25% of project cost
3. Debt service of Airport Funded Cost; assumes 4% interest rate, 20 year term and 2.8% Direct Subsidy (70% Tax Credit Rate)
4. Based on FAA guidance of 1% of capital cost
5. Both the CREBs and QECBs airport assumed cost include the 4.1% Bond Issuance Cost, accumulated bond coupon payments and annual O&M Costs
6. Average Annual debt service GARB; assumes 4% interest rate amortized over 20 year term.
7. Airport assumed cost include the 4.1% Bond Issuance Cost, accumulated bond coupon payments, annual O&M Costs and capitalized interest(year one)
Assume 25-year life of the facility
All in 2015 costs

3.2.2 Third Party-Owned

In a third party-owned project, the airport leases out property (land or building) to a private developer who will construct, own and operate the facility under a long-term lease agreement. Third party-owned projects are particularly attractive in states where there is a strong solar power market and private entities are actively looking for development sites and green power purchasers. In these situations, development companies profit from solar developments primarily due to the ability to monetize the federal investment tax credit (ITC), which is currently equal to 30% of the project installation cost, and state incentives for renewable energy which direct utilities to purchase green power at a premium price.

The third party requires a site and a power purchaser. The airport may act as the host only and receive an annual lease payment. To keep project costs down, the third party will look for inexpensive land with low lease rates, and thus where the airport does act only as host, the lease payment will be for land that has little market value and no other uses. Alternatively, the airport can also act as the power customer by executing a power purchase agreement (PPA) to purchase the electricity at a mutually agreed upon price. The PPA is a critical aspect of project financing because it guarantees a long-term revenue stream during facility operation which assures that investors will receive a return on their investment based on the established PPA price of electricity. In the scenario where the airport buys the power, it executes a land lease for a nominal cost and earns a financial benefit through an electricity price agreed to in the PPA that serves its long-term business interests. Third parties may have an interest in developing renewable energy projects at airports because airports are a credit worthy, long-term purchaser of energy.

3.2.2.1 Overview and Roles

As described above, the solar project development requires the same expertise for the airport and third party-owned cases, but the roles and responsibilities are different.

In the third party case, the airport identifies surplus property suitable for solar and issues a RFP to select a private party to build, own and operate the facility. Where the airport also intends on executing a PPA, it will include a form of the PPA with terms in the RFP and evaluate price proposals as part of the selection of the solar development partner. Once it selects the third party, unlike the airport-owned scenario, the airport acts as a more passive partner in the project development providing the third party with access and information necessary to develop the project while also working with the FAA to ensure that it approves of the project for airspace safety and grant assurances purposes.

The third party assumes the majority of the risk associated with project development. It must ensure that the project meets its performance obligations to supply a minimum amount of electricity to the airport. The airport's risk is primarily associated with its long-term commitment to buy the electricity and the unknown cost of comparable electricity available on the market.

3.2.2.2 Financing Options

The drivers for the third party financing analysis are described in Section 3.1, Public Policy Context. A private developer can take advantage of the federal ITC as well as accelerated depreciation of solar energy equipment to further limit tax liability and reduce development costs. State-specific incentives for solar PV are not strong in Wisconsin and no additional market value from state or regional drivers can be applied to a third party financing analysis at GMIA. While Wisconsin has Renewable Portfolio Standard (RPS) targets which require utilities to supply 10% of all electricity in a renewable form, the utilities are providing those resources from wind, hydropower, and biomass which are more economical to acquire than solar. As a result, there is no market for solar to drive up demand and meet the higher costs to produce.

3.2.2.3 Financial Analysis

A financial analysis has been prepared to evaluate a third party-owned solar project sited on airport property. The analysis uses the same design assumptions as were used for the airport-owned analysis and provided in Table 3-3. Rather than analyzing specific sites like was conducted for the airport-owned scenario, we have instead assessed a 1 MW-dc solar project assumed to occupy portions of the sites near the Terminal interconnection considered above and included project cost scenarios for both ground-mounted and carport systems. The primary reason for doing so is that a private party, once selected, will operate best if it has some siting and design flexibility and therefore the 1 MW model project provides a better baseline than locking the private party into a single confined project. The annual electricity generation from the system used is an average of the four sites scaled to a 1 MW-dc facility.

Table 3-8 provides the results of the financial analysis. It shows that for a private party to own and operate a 1 MW solar facility at GMIA and provide the equity investors with a 10% return on their investment, the facility owner would need to execute a power purchase agreement with a buyer for 17.6¢/ kWh in year one with the electricity price increasing by 3.5% annually.

Table 3-8. Key Financial Factors for Third Party-Owned Facility

Factor	Value
Federal Investment Tax Credit	30%
After-Tax IRR Target, unlevered	10.0%
PPA Required for Target IRR	17.6 ¢/kWh
PPA Escalation Rate	3.5%
Airport NPV, Lease Payments @ 4%	$102,149

The following two tables provide a sensitivity analysis to illustrate how changes in particular financial factors can affect the investor rate of return (IRR). As assumed above, it is expected that investors will want a 10% return on their equity investment. This can be achieved, as presented in the base case by obtaining a buyer for the power agreeable to paying 17.6¢/ kWh in year one and annual prices thereafter that increase by 3.5%. In Table 3-9, we can see that increasing the PPA price to 20¢/ kWh can reduce the annual escalator to about 2% and still achieve the 10% investor rate of return. Alternatively, the escalator could be increased to slightly under 5.5% which would bring the PPA price in year one down to 15¢/ kWh.

Table 3-9. Change in After Tax IRR due to Variation in PPA Price and Escalation Rate

Sensitivity Analysis							
		PPA Price (cents/kWh)					
		7.7	10.0	12.5	15.0	17.5	20.0
PPA Escalation Rate	1.5%	-0.3%	2.2%	4.4%	6.3%	8.0%	9.5%
	2.5%	0.9%	3.3%	5.4%	7.3%	8.9%	10.5%
	3.5%	1.9%	4.3%	6.4%	8.2%	9.9%	11.4%
	4.5%	3.0%	5.3%	7.4%	9.2%	10.8%	12.3%
	5.5%	4.0%	6.3%	8.3%	10.1%	11.7%	13.2%

In a similar analysis, Table 3-10 presents how changes in the combination of PPA price and installed cost can achieve the 10% IRR. The carport installed cost of $3,800 / kW requires a power purchase price of just over 20¢/ kWh to achieve the 10% IRR target.

Table 3-10. Change in After Tax IRR due to Variation in PPA Price and Installed Cost

Sensitivity Analysis							
		PPA Price (cents/kWh)					
		7.7	10.0	12.5	15.0	17.5	20.0
Installed Cost ($/kW)	$2,400	2.6%	5.0%	7.1%	9.0%	10.7%	15.2%
	$2,500	2.3%	4.6%	6.8%	8.6%	10.3%	14.7%
	$2,600	1.9%	4.3%	6.4%	8.2%	9.9%	14.2%
	$2,700	1.6%	4.0%	6.1%	7.9%	9.5%	13.7%
	$3,800	-1.1%	1.2%	3.2%	4.8%	6.2%	9.9%

Note: the installed cost of a ground-mounted project is estimated to be $2,600; the installed cost of a carport is $3,800

3.2.2.4 Self-Sustainability Benefits of Long-term Contracts

PPAs provide airports with two benefits: one that is assured; the other that is assumed. By purchasing power for the next 15-25 years, the airport is assured that its price of power will be stable and predictable. The primary benefit is that the PPA provides cost certainty and is a hedge or an insurance policy against episodic price volatility and long-term significant price increases. It is not a guarantee of long-term cost savings because the future price of electricity is not known. Electricity prices in the U.S. have increased 50% since 2002. Based on this history and trends, we assume that prices will continue to increase; however, there is no guarantee that this will occur.

3.3 Review of Other Airport Solar Projects

A number of solar projects have been successfully developed at airports around the U.S. Each project benefitted from the siting characteristics that make solar and airports compatible, including available flat land and buildings, unobstructed views of the sun, and a large on-site electricity load. However, there are other key factors that have made specific solar PV project at airports successful including an engaged utility company providing grants and long-term contracts, state policy incentives requiring solar purchasing, and high existing electricity prices. The following three examples are offered to show how solar projects have been cost-effectively developed at airports.

3.3.1 Indianapolis International Airport

Indianapolis Airport is host to a 25 MW solar farm that covers 162 acres of land and produces enough electricity to power 3,210 homes. The project is a third party development where the private entity leases the land from the airport and sells the electricity to the utility, Indianapolis Power & Light (IP&L) through a 15 year power purchase agreement (PPA). The financing for the project was driven by the PPA and the PPA price agreed to by IP&L which is 20¢/ kWh for 15 years. The airport is not involved with the power transaction. It receives an annual lease payment of approximately $250,000 for use of its land.

IPL proposed a Feed-in Tariff (FiT) Program to purchase 1% of its electricity supply in the form of renewable energy. The FiT, which was approved by the Indiana Utility Regulatory Commission in March 2010, set the price and term of long-term contracts for renewable energy. While biomass, solar and wind power were all eligible for the program, large scale solar projects including those at Indianapolis Airport and the Indianapolis Motor Speedway were approved and constructed. IPL established the program to diversify its energy mix with renewable sources that provide long-term price stability. Given that the state legislature had not enacted renewable energy purchasing requirements, IPL established its FiT Program as a voluntary pilot program.

3.3.2 San Diego International Airport

The San Diego County Regional Airport Authority (SDCRAA), which owns and operates San Diego International Airport, issued an RFP and selected a subsidiary of Borrego Solar to build, own and operate a 3.3 MW solar project on the Terminal roof and on carports over surface parking areas and sell the electricity generated back to the airport under a long-term power agreement. The price of the electricity set in the PPA is a fixed rate of 13.67¢ /kWh for 20 years. The airport's current electricity rate is about 15¢ /kWh. With electricity prices expected to increase and the airport's PPA rate held constant, savings are projected to grow with the 20 year total savings being $4-9m depending on the actual price of electricity.

The SDCRAA pursued a solar program following the creation of a Sustainability policy governing facility construction and the execution of a memorandum of understanding with the California Attorney General that mandates air quality improvements as a condition for facility expansion. The recently completed GreenBuild Project includes the Terminal 2 expansion, which became the world's first commercial aviation Terminal certified under the US Green Building Council's Leadership in Energy and Environmental Design (LEED) program at the Platinum level. The solar projects will give the terminal additional LEED points. SDCRAA also recently completed a 12kv micro grid that allows it to own and manage the electrical infrastructure on airport property. It is currently planning to integrate renewable energy and energy storage into the micro grid that will allow it to "island" the airport and operate self-sustainably in the event that the grid should fail.

3.3.3 Minneapolis-St. Paul International Airport

The Xcel Energy Renewable Development Fund, which is financed by Xcel Energy rate payers, awarded a $2,022,507 grant to the Metropolitan Airport Commission for a 1,180 kilowatt roof-mounted photovoltaic array to be installed on the upper deck of the Gold Parking Garage at Terminal One of the Minneapolis-St. Paul International Airport. The solar equipment will be installed on structural support so as to maintain current parking spaces on the upper deck. The solar PV facility will reduce peak loads during on-peak periods when electricity rates are highest. Since the award of the grant, the project has been expanded to a $25m project that includes a 3.1 MW solar project and energy efficiency improvements.

While not all of the financial details of this project are public, the elements that contribute to its cost-effectiveness include:

- A $2 Million grant from Xcel Energy.
- Off-setting electricity purchased from the utility at the highest, on-peak electricity rate. The time of use rate for commercial rate payers in Minneapolis is summer on-peak at 14.3¢/ kWh and winter on-peak at 11.6¢/ kWh.
- The project is combined with an energy conservation program and it is likely that cost savings achieved over the next five years are being reinvested into paying for the solar project.

4 Legal Issues and Coordination with the Utility

Under Task 3 of the project, HMMH has been directed to investigate legal issues associated with large-scale solar PV projects under federal, state and local law including the legality of power purchase agreements. In addition, we were charged with contacting the local utility company to understand the feasibility of a project at GMIA and steps necessary to obtain approval to interconnect the facility to the electric grid. These issues and a summary of project implementation are provided in this section.

4.1 Legal Issues associated with Large-scale Photovoltaic Projects

Electricity sales and use of the electrical grid are regulated by federal and state laws. The following section is not a detailed legal analysis but a summary of issues relevant to solar PV projects in Wisconsin.

4.1.1 Net Metering Legal Basis

Federal law under the Public Utilities Regulatory Policies Act (PURPA) of 1978 requires utilities to purchase power exported onto the grid by "qualifying facilities" under so-called net energy metering. PURPA requires the facility to compensate the generator for the avoided cost. State policies have been enacted in many states to provide a greater level of compensation to encourage distributed generation projects. We Energies compensates exported electricity at the avoided cost in compliance with PURPA.

4.1.2 Power Purchase Agreements in Wisconsin

State laws typically limit the sale of electricity "at retail" to only those in the regulated utility sector. In states where clarifying legislation or a court decision has not occurred, the law could be interpreted to prohibit the sale of electricity through a power purchase agreement (PPA) if the contract is a "retail sale" and the seller isn't a regulated utility and is not authorized to conduct retails sales without first being regulated as a utility. The state of Wisconsin has legislation that clearly states the utility monopoly rights/territorial rights laws to sell electricity. However, such statutes were written well before distributed generation through technologies like solar was contemplated, so many state laws are silent on solar PPAs. Given the ambiguity, utilities in some states have reacted to proposed solar PPAs by challenge them as illegal.

In such a case in the State of Iowa referred to as Eagle Point, the Iowa Utilities Board sued Eagle Point Solar which had negotiated a PPA with the City of Dubuque to lease rooftops on city-owned buildings and build, own, and operate the facilities and sell the electricity to the City through a PPA. In July 2014, the Iowa Supreme Court ruled that the solar PPA was legal under Iowa state law. The same issue has come about in the state of Georgia where a bill has been filed, HB 57, which seeks to clarify the legality of solar PPAs and avoid a law suit like the one that occurred in Iowa.

Wisconsin state law will continue to lack clarity until legislation is enacted that specifies the legality of PPAs. There is a campaign to achieve this through the Clean Energy Choice Program and a proposal to approve the City of Morona's PPA for 146 kW of solar electricity with Madison Gas & Electric. Passage of state legislation explicitly permitting the sale of solar energy to off-site parties through a power contract would facilitate solar development on property owned and managed by Milwaukee County including General Mitchell International Airport.

4.2 Interconnection Approval

The HMMH team contacted representatives from We Energies to discuss the interconnection process in general and the specifics of a project at GMIA. The information they provided is summarized in the two sections below.

4.2.1 Overview of the Interconnection Process

The electrical interconnection process for the interconnection of customer-owned generation facilities, such as a proposed solar PV project at the GMIA, is described in Wisconsin Public Service Commission Chapter PSC 119 – Rules for Interconnecting Distributed Generation Facilities and the We Energies document entitled "Technical Requirements for the Interconnection of Customer-Owned Generation Facilities to the We Energies Distribution System – Supplement to PSC 119."

The interconnection process is similar for both a solar PV project interconnected to the GMIA-owned electrical distribution system and a project interconnected directly to the We Energies electrical distribution system (i.e. not behind the existing primary revenue meters located at the 24.9 kV delivery points to GMIA). PSC 119 addresses four (4) categories of distributed generation ("DG") facilities on the basis of the DG facility capacity. A solar PV project at is likely to be covered as a Category 3 (greater than 200 kW and not more than 1 MW) or a Category 4 (greater than 1 MW and not more than 15 MW).

The interconnection process begins with the completion and submittal to We Energies of the proper Standard Distributed Generation Application form which, for Category 3 and 4 projects, is PSC Form 6028. The completed interconnection application must include an electrical one-line schematic diagram and a site plan of the DG facility, along with an application fee of $500 for a Category 3 project or $1,600 for a Category 4 project.

The requirements for the electrical one-line schematic diagram and the site plan are described in PSC 119 in Sections 119.10 and 119.12. These requirements include a disconnect switch to provide a visible and lockable isolation of the solar PV project from the We Energies electrical distribution system (whether the project is interconnected to the GMIA-owned electrical distribution system or interconnected directly to the We Energies electrical distribution system) that is accessible to We Energies staff at all times, anti-islanding protection functionality, and an automatic interrupting device. In addition to the anti-islanding equipment, Category 3 and 4 DG facilities shall include over/under frequency relays, over/under voltage relays, and phase/ground overcurrent relays. This equipment must be depicted on the electrical one-line schematic diagram and located on the site plan. PSC 119, Section 119.04 describes the steps and timelines regarding the review of the interconnection application package by We Energies. These steps include: (i) ascertaining the interconnection application is complete and notifying the applicant accordingly; (ii) determining if additional engineering review is necessary and, if so, the cost of the additional engineering review; (iii) determining if a distribution system impact study is necessary and, if so, the cost of the study; (iv) determining the cost of any required distribution system improvements that would be borne by the interconnection customer; and, (v) the commissioning and witness testing of the DG facility.

We Energies may also require telemetry equipment to remotely ascertain the voltage at the DG facility and the current, real power, and reactive power transfer between the DG facility and the rest of the distribution system. In cases where islanding may be possible despite the protection functions described above (e.g. when the load on the distribution circuit or circuit section and the DG output may be matched), We Energies may also require direct transfer trip equipment that would send a signal to the DG facility and cause it to be disconnected. The need for these additional requirements would be determined through the initial engineering review and, if necessary, the distribution system impact study conducted by We Energies.

4.2.2 Interconnecting a Project at GMIA

The HMMH team discussed the potential for interconnecting a solar PV project to new electrical circuit on the west side of the parking garage. We Energies indicated that they may prefer the disconnect switch to be located adjacent to the revenue meter. HMMH suggests that such an arrangement would not be good for the airport because the PV project could have an impact on the electricity feeding the core operations of the airport. We would recommend that if discussions proceeded that it would be best for the airport if the disconnect switch were located on the PV project site.

The airport's electrical engineer also stated that access to the new GMIA switchgear where the solar facility would physically interconnect requires passing thru airport security. This condition further supports the idea that the disconnect switch should be located at the PV project site so that We Energies could have unfettered access to the disconnect switch 24/7.

While much of the focus has been on interconnecting the solar project at the Terminal, early discussions with We Energies suggested that they would be receptive to interconnecting new, stand-alone (i.e. not behind an existing GMIA meter) PV projects. This would open up the potential for utilizing airport property to the north, south and east, where airport meters are either too small or do not exist. However, there was not sufficient time during the study for discussions with We Energies staff to progress, and therefore project siting was directed to the Terminal area. Given that any project that were to directly connect to the We Energies infrastructure would be a third party-owned facility (because there would be no on-site meter to accept the electricity) requiring a power purchase agreement, discussions about such a project would need to occur on a policy level with acceptance of a project concept with We Energies.

4.3 Project Implementation

Should the airport decide to proceed with a solar project, it will need to consider the following additional issues associated with project implementation.

4.3.1 Coordination with the FAA

Regardless of what site is selected and which financing and ownership structure is pursued, it is important to discuss the project with the FAA regional office. The FAA has broad jurisdiction over development and activities proposed on airport property and the airport management will want to make sure that the FAA is informed to ensure that it exercises its appropriate authorities. The coordination will address consistency with Master Planning and airspace safety as well as grant assurances of federally-obligated airports. Should the airport consider the option of accessing FAA grant programs, it will want to review the existing capital improvement program and standards of review that the solar project might be subject to and implications for other projects that have been identified and programmed. The airport should also consult with the FAA about the applicability of its obligations under the National Environmental Policy Act (NEPA).

4.3.2 State and Local Approvals

Many potential environmental permitting requirements are mitigated through the site selection process and avoiding resources that may be protected by regulatory programs. Two of the preferred sites (1 and 15) would be located on existing developed areas used for parking. The other two sites (13 and 14) are grassy landscaped areas managed by the airport. The environmental mapping information suggests that these areas do not contained regulated wetland areas though a field investigation could confirm this initial conclusion. Regarding wetlands and SEWRPC environmental corridors, there are no required setbacks for developing adjacent to these resources as Milwaukee County is exempt from shoreland/wetland zoning restrictions under Wisconsin Administrative Code NR 115.

In 2012, the City of Milwaukee passed a solar zoning ordinance which incorporates the existing Wisconsin State Statute 66.0401 that limits the authority to restrict a homeowner or business owner's right to install solar. The project is still required to obtain electrical and building permits from the City's Department of Community Development. The Solar Permit Worksheet, as provided by the City of Milwaukee (http://city.milwaukee.gov/MilwaukeeShines/Solar-Professionals/Permitting.htm#.VXXUbkZIt-4), helps applicants determine what information must be submitted with the permit applications including specific information required for building mounted and ground mounted arrays.

4.3.3 Procurement

All goods and services sought by the airport will need to be procured through a public bidding process. Whether the airport seeks design and engineering services, construction services, and/or wishes to lease land to a private entity and execute a power purchase agreement, it will need to prepare an RFP or RFQ for those services and advertise the bid in accordance with federal, state and local laws.

4.3.4 Timelines

Several keys scheduling factors must be considered when determining when and how to proceed with implementing a solar project at the airport. They include the following:

- Any project which seeks to engage a private third party owner must be aware of the forthcoming reduction in the federal Investment Tax Credit (ITC). After December 31, 2016, the tax credit will be reduced from 30% to 10% of the total project cost. While it is possible that the ITC could be extended by Congress, it is a significant uncertainty. Projects that are marginally viable with the 30% tax credit are unlikely to be viable with a reduction to 10%.
- The Renewable Energy Competitive Incentive application and project selection occurs twice per year in the spring and the fall. The schedule for the fall program has not been released. The airport should consider the funding schedule should it seek a grant through Focus on Energy.
- The interconnection process will take approximately 6 months if complete information is submitted and no complex issues arise.
- FAA airspace review can take 2-3 months from when information is filed.
- AIP funding is governed by the Federal Fiscal Year which starts in October 1.

5 Conclusions and Recommendations

5.1 Primary Findings

This report has reviewed the airport energy usage patterns and predicted solar PV generation potential from the four preferred sites located near the airport entrance and terminal electrical interconnection point. We conclude that a 1 MW solar project can be located behind-the-meter with all of the energy generated consumed by the airport terminal without any power being exported back to the grid. The value of the solar electricity is equivalent to the cost of the electricity that otherwise would have been purchased from the grid which is 7.7¢ / kWh.

We then prepared a financial analysis of airport-owned solar facility and a third party-owned facility. We determined that the most cost-effective option and the only one that results in a positive annual return would be an airport-owned project funded with a 75% grant under the Airport Improvement Program (AIP). However, the airport has other airport capital projects committed for future funding which have already been approved by the airlines and replacing those with a solar project will be challenging to demonstrate on a direct cost-effectiveness basis.

A third party would require the airport or other entity to purchase the electricity output from the facility at 17.6¢ /kWh to achieve a 10% investor rate of return. This electricity rate is considerably more than what the airport currently pays for electricity 7.7¢ /kWh and therefore would not be economical for the airport to purchase the power through a PPA. This rate is also higher than commercial electricity rates in Wisconsin and the pool of purchasers for the high cost power is limited.

We also reviewed the legal issues associated with large scale solar PV facilities in Wisconsin and concur that there is ambiguity in existing state law that leaves a potential third party developer open to a suit from the utility. However, there is an active campaign in Wisconsin to clarify the law and recent court decisions in other states have supported the legality of third party solar PPAs. Passage of state legislation explicitly permitting the sale of solar energy to off-site parties through a power contract would facilitate solar development on property owned and managed by Milwaukee County including General Mitchell International Airport.

Finally, we coordinated with We Energies and confirmed the process for interconnecting a facility to the Terminal electrical system. However, a future policy level conversation would be necessary to determine if a project could be located on more remote parts of the airport and directly interconnect to the We Energies distribution system.

5.2 Discussion

5.2.1 Airport-Owned

Although several funding options are available for an airport-owned solar project, there are few that are available to GMIA due to its current commitments and financing limitations. It is County policy to issue only GARBS for GMIA, making tax credit bonds such as CREBs or QECBs unavailable. While GARBs could be issued, the Airport would require airline approval for the bonds and to extend their bonding authority beyond its current time limit. The use of AIP funds is eliminated by the need for higher priority projects in the Airport's CIP. PFCs could be considered, but would require consultation with the airlines. The project could be funded with pay-as-you-go PFCs and scheduled so that the initial capital requirements were collected prior to initiation of the project. If PFCs were used to cover financing costs of a bond, they would either need to be included under the remaining CIP bond cap and included in rates and charges, or issued outside of that cap.

Based on our review, none of the funding methods evaluated provided a positive return on investment except for use of AIP funds, including PFC pay-as-you-go funds.

The airport is eligible for a Renewable Energy Competitive Incentive Program (RECIP) under the Focus on Energy utility incentive programs. Even if it received the maximum grant of $500,000 to decrease the initial cost of a 1 MW project and used energy bonds to fund the remainder, the project would still result in a negative annual return to the airport. An alternative could be to fund a smaller project (e.g., 250-500 kW) which with a lower airport investment could prove to be cost-effective.

As a large user of electricity and with a new circuit recently constructed which expands electricity delivery capacity to the Terminal complex, there is opportunity to install a utility scale solar project behind-the-meter and maximize the direct use of the power at the Terminal. What limits the economic viability of this option is the energy rate that the airport pays for electricity relative to the cost of solar PV electricity during on-peak hours (8am to 8pm) when the solar facility would generate power and the airport would purchase less electricity from the utility. The airport pays an on-peak rate of 7.7¢ / kWh. As a comparison, the reported summer peak rate for commercial customers in Minneapolis-St. Paul (Xcel service territory) is 14.3¢ / kWh.

5.2.2 Third Party

While the state of Wisconsin has a Renewable Portfolio Standard which requires utilities to deliver a minimum amount of renewable energy to its customers (10% by 2015) which is a driver for purchasing renewable energy at above market electricity rates, the utilities are meeting that mandate by purchasing wind, hydropower, and biomass which is being produced more economically in the region than solar.

Many airports lease land to a private developer who executes a power purchase agreement (PPA) with the airport to purchase the electricity and share in the financial benefit. While other states have passed legislation specifically allowing PPA arrangements, the law in Wisconsin supporting the legality of PPAs is unclear and the utilities may contend that PPAs are not allowed under current law. A recent Supreme Court decision in Iowa found in favor of a solar company and a PPA agreement to sell power produced from solar to the City of Dubuque. Legislation is currently before the legislature in Georgia that would clarify its law to specifically allow solar PPAs. There is an active campaign to enact similar legislation in Wisconsin. Absent legislation or formal policy from We Energies, there remains legal risk associated with a third party ownership agreements financed through a PPA.

5.3 Next Steps

As the project moves forward, additional study should be performed to refine costs associated with development of the solar PV project on each of the potential sites and provide information for design. These studies may include:

- Evaluation of facility layout on each site to confirm assumptions of space required
- Structural evaluation of the parking garage to confirm that canopy structures could be constructed over the top level or that the PV panels could be mounted on the existing central circulation roof.
- Evaluation of interconnection to the power grid from each site
- Review of topography on Sites 13 and 14 to determine the work associated with preparing the site for installation.
- Geotechnical evaluation of the soils on Sites 13 and 14 to inform foundation design.

We also recommend that the County engage We Energies in a policy discussion about the opportunity of building a distributed generation solar facility at the airport as a demonstration project.