Milwaukee County

Solar Photovoltaic Systems

FEASIBILITY STUDY

Milwaukee, Wisconsin
August 23, 2024

TOGETHER, BUILDING A THRIVING PLANET

McKinstry
For The Life Of Your Building

Contents

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SECTION 1

Project Summary

Project Summary

Milwaukee County Solar Feasibility Study | Project Charter

Project Objective

- Develop the Solar Photovoltaic (Solar PV) Feasibility Plan as a key piece to the County's larger efforts to decarbonize its operations.

Big Questions

- What County properties offer the best sites for on-site solar development?
- How to balance sustainability, community equity and economic priorities of the County?
- What does realistic, phased implementation to achieve project goals entail?
- Will the proposed on-site solar PV arrays provide sufficient renewable energy generation to achieve the 2030 goal of reducing GHG emissions 50% using 2005 as a baseline?

Main Points of Contact

Milwaukee County Project Management Team

- Stuart Carron – Facilities Management Division
- Grant Helle – Office of Sustainability

McKinstry Project Delivery Team

- Sam Bluemer-Garibay – Account Management
- Sean Currie – Project Management
- Kate Pearson – Project Engineering
- Eric Rehm – Policy & Financial Development
- Sara Berry-Maraist – Inflation Reduction Act (IRA) & Funding Specialist
- Nick Laubusch – Project Implementation

Strategies

- Apply a feasibility matrix to modeled solar PV systems to ascertain an objectively prioritized list of potential projects.
- Optimize carbon emission offsets while maximizing economic benefit and available incentives from state, local and federal funding sources.
- Work in collaboration with County staff and leadership to review study findings and to create a final Solar PV Feasibility Plan for inclusion in the County's Climate Action 2050 Plan.

Deliverables

- Solar PV Feasibility Report with preliminary, phased implementation plan.
- Presentation documents for report out to County Committees.

Project Summary

Key Project Activities

1. Assess County sites with annual consumption >100,000 kWh for solar photovoltaic (PV) applications
    - This list included 38 County properties ("prequalified sites")
2. Conduct load (electric usage) profiles for preliminary sites list
3. Review relevant past reports/studies, capital plans, roof data, building drawings and diagrams
4. Build preliminary solar PV models for preliminary sites
5. Determine site visit list based on activities #1-#4
6. Adjust solar PV models and refine site list based on:
    - Solar production capacity
    - Cost to implement
    - Potential incentives (state + federal)
    - Energy & demand cost savings
    - Carbon emissions offset
7. Finalize recommended solar PV projects
8. Develop report summarizing findings and key information

FINDINGS[1]

FACTOR	IMPACT
# of Systems Recommended	22 (Across 17 Sites)
Cumulative Proposed Systems' Size	11.196MW_{DC}
Carbon Offset[2]	214,519 Tons
% County Operations Emissions Offset[2]	6.5%
30-Year Energy Production Value[3]	$55,748,685
Cost to Implement[4]	$44,899,695
Estimated $ Incentive/Watt Installed[5]	$1.11/watt

[1] See the *Project Overview* section for a comprehensive Findings Summary table.

[2] Excludes carbon emissions associated with exported solar production.

[3] Estimated cumulative cashflow for all 22 proposed systems including energy cost and demand charge savings not including incentives.

[4] Estimated cost to implement all 22 recommended systems +/-30%.

[5] Includes base Inflation Reduction Act (IRA) Direct Pay incentive of 25.5%, Energy Community Bonus 10% (if applicable), and Focus on Energy (FOE) incentives.

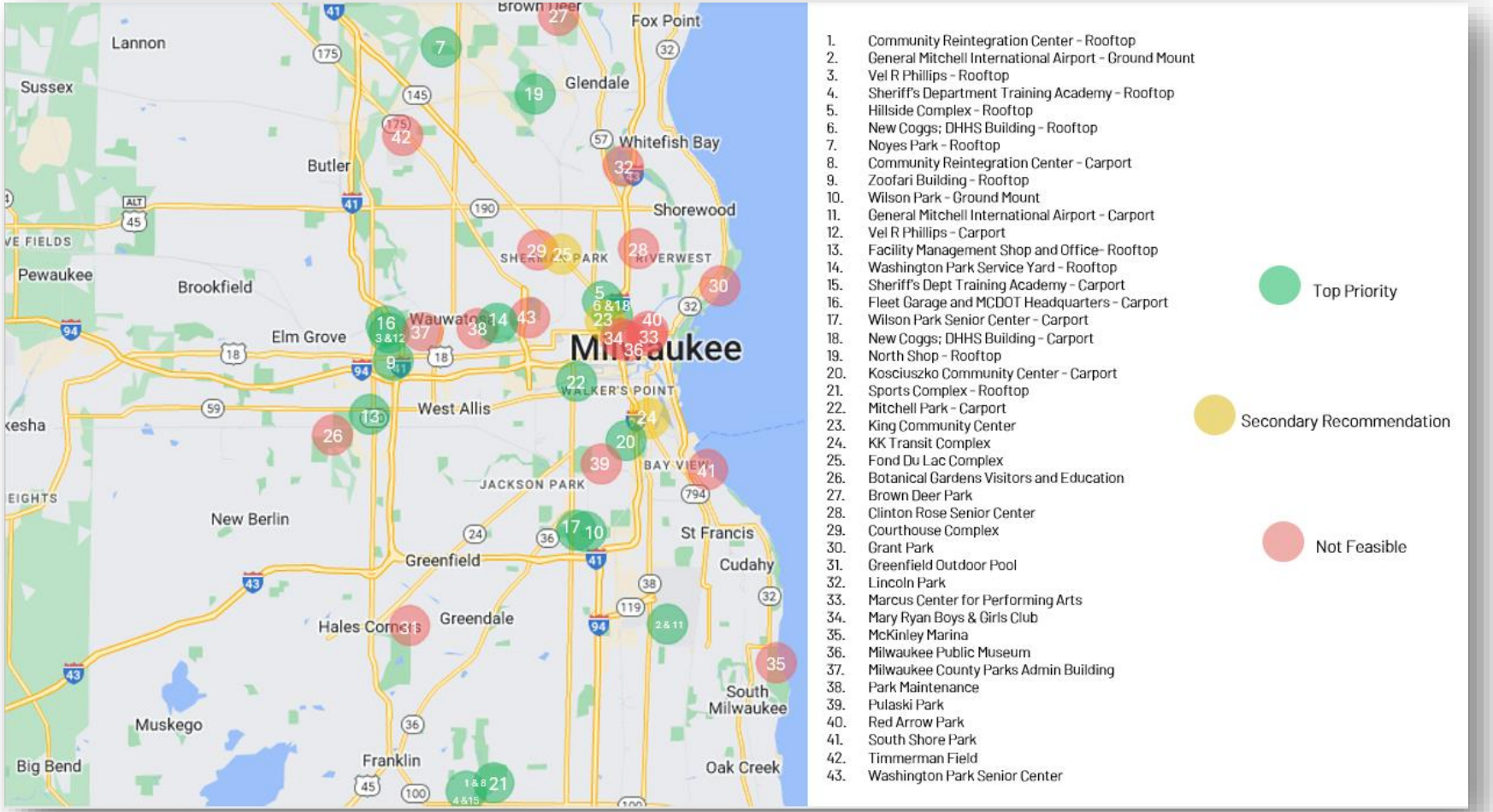
Site Recommendation List

1. Milwaukee Mitchell International Airport
2. Community Reintegration Center
3. Hillside Complex
4. Vel R. Phillips Youth and Family Justice Center
5. Wilson Park
6. Fleet Garage & MCDOT Headquarters
7. *New* Coggs Dept. Health & Human Services
8. Sheriff Dept. Training Academy
9. Mitchell Park
10. Sports Complex
11. Kosciuszko Community Center
12. Wilson Park Senior Center
13. Milwaukee County Zoo - Zoofari Building
14. Facility Management Shop and Office
15. Noyes Park
16. North Shop
17. Washington Parks Service Yard

The Climate and Equity Plan supports Milwaukee County's goals to:

1. **Reduce carbon emissions resulting from County operations** by 50% by 2030 and achieve net-zero emissions by 2050.
2. **Improve racial and economic equity** by creating green training and apprentice programs that lead to family-supporting jobs for underserved communities.

Project Summary



Project Summary

SITE	TYPE	PROPOSED SYSTEM SIZE (DC)	ESTIMATED PROJECT COST	ESTIMATED[6] IRA IMPACT	ESTIMATED FOE INCENTIVE	CUMULATIVE NET CASHFLOW (30 YEARS)	RETURN ON INVESTMENT (ROI)	% COUNTY[7] CARBON OFFSET
Milwaukee Mitchell International Airport	Carport	2,046.7	$9,005,524	$2,296,409	$25,000	$8,297,202	24%	1.39%
Milwaukee Mitchell International Airport	Ground Mount	1,019.5	$2,952,701	$752,939	$25,000	$5,605,764	158%	0.81%
Sports Complex	Rooftop	272.6	$1,022,175	$260,655	$13,629	$1,122,950	50%	0.09%
Kosciuszko Community Center	Carport	254.3	$1,335,023	$340,431	$12,715	$1,125,369	15%	0.13%
Wilson Park Senior Center	Carport	240.7	$1,263,780	$322,264	$12,036	$1,356,433	46%	0.10%
Milwaukee County Zoo - Zoofari Building	Carport	171.1	$650,180	$221,061	$8,555	$843,572	101%	0.09%
Facility Management Shop and Office	Rooftop	129.2	$503,919	$128,499	$6,461	$632,945	72%	0.06%
Noyes Park	Rooftop	96.8	$396,716	$101,163	$4,838	$497,385	71%	0.06%
North Shop	Rooftop	49.6	$203,196	$51,815	$2,478	$248,018	67%	0.02%
Washington Park Service Yard	Rooftop	33.6	$142,928	$36,447	$1,682	$183,612	75%	0.01%
Community Reintegration Center	Carport	1,474.4	$6,634,845	$1,691,885	$25,000	$7,147,274	45%	1.02%
Community Reintegration Center	Rooftop	479.7	$1,319,093	$336,369	$23,984	$2,913,147	204%	0.36%
Hillside Complex	Rooftop	1,071.4	$2,732,172	$696,704	$25,000	$5,536,958	175%	0.55%

[6] Assumes tax-exempt financing, excludes competitive bonuses.

[7] Offset of 2022 CO_2 data in Year 1 of proposed system's operation.

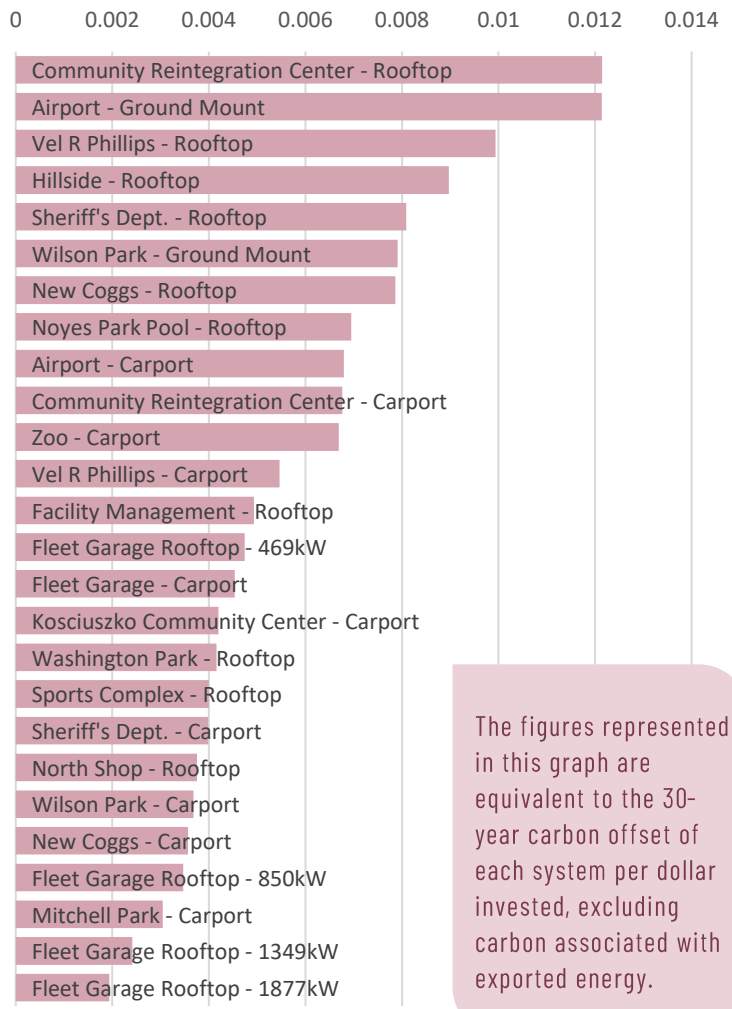
Project Summary

SITE	TYPE	PROPOSED SYSTEM SIZE (DC)	ESTIMATED PROJECT COST	ESTIMATED[6] IRA IMPACT	ESTIMATED FOE INCENTIVE	CUMULATIVE NET CASHFLOW (30 YEARS)	RETURN ON INVESTMENT (ROI)	% COUNTY[7] CARBON OFFSET
Vel R Phillips Juvenile Justice Center	Carport	778.8	$3,543,540	$1,204,804	$25,000	$3,650,744	58%	0.39%
Vel R Phillips Juvenile Justice Center	Rooftop	275.5	$1,033,238	$351,301	$13,777	$1,640,698	146%	0.20%
Wilson Park	Ground Mount	771.7	$2,430,918	$619,884	$25,000	$3,655,225	105%	0.43%
Fleet Garage & MCDOT Headquarters	Carport	636	$2,893,891	$983,923	$25,000	$2,910,699	54%	0.26%
New Coggs & DHHS Building	Carport	579.4	$2,723,086	$694,387	$25,000	$3,171,381	58%	0.22%
New Coggs & DHHS Building	Rooftop	38.9	$165,495	$42,201	$1,947	$212,371	75%	0.03%
Sheriff's Department Training Academy	Carport	314.5	$1,635,244	$416,987	$15,724	$1,668,674	39%	0.15%
Sheriff's Department Training Academy	Rooftop	98.5	$403,973	$103,013	$4,927	$651,780	120%	0.07%
Mitchell Park	Carport	363.4	$1,908,060	$486,555	$18,172	$1,892,733	35%	0.13%
Fleet Garage & MCDOT Headquarters	Rooftop	469	$2,260,800	$768,672	$23,455	$2,108,292	44%	0.24%
Fleet Garage & MCDOT Headquarters	Rooftop	850	$3,823,200	$1,299,888	$25,000	$3,153,250	26%	0.28%
Fleet Garage & MCDOT Headquarters	Rooftop	1,349	$5,664,708	$1,926,001	$25,000	$5,204,219	40%	0.30%
Fleet Garage & MCDOT Headquarters	Rooftop	1,877	$7,507,160	$2,552,434	$25,000	$2,003,740	-59%	0.32%

Project Summary

Top Environmental Performers

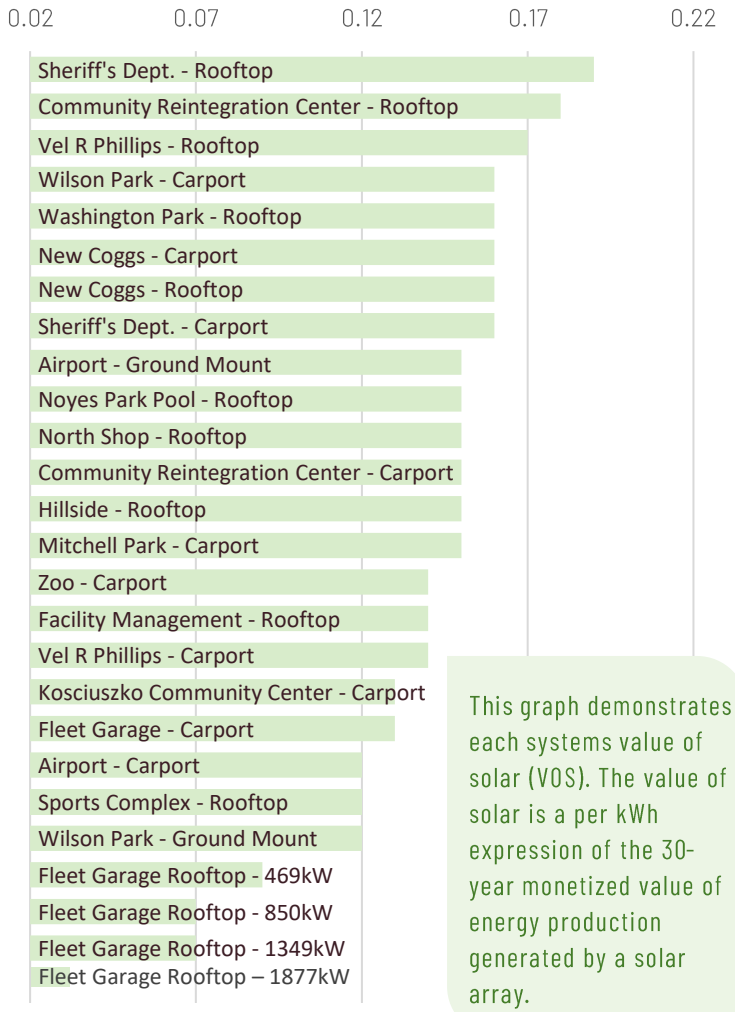
$MCTCO_2e$/Dollar Invested



The figures represented in this graph are equivalent to the 30-year carbon offset of each system per dollar invested, excluding carbon associated with exported energy.

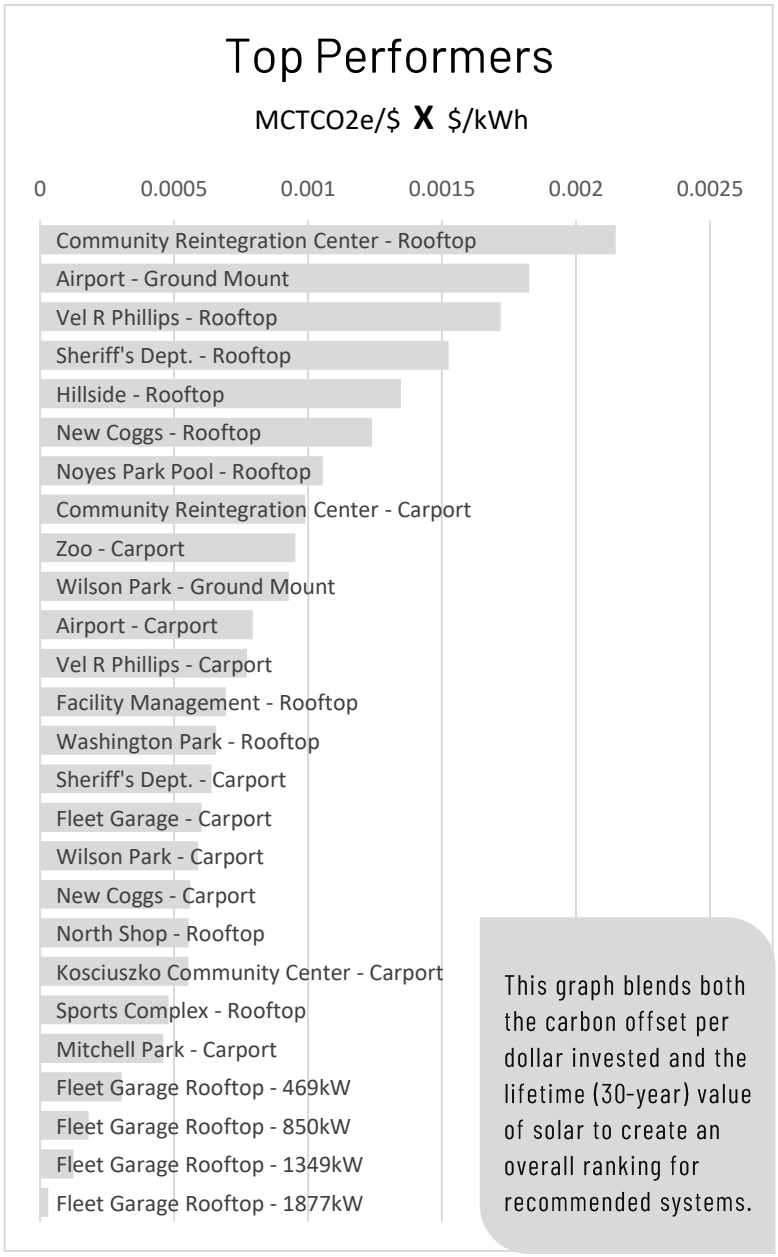
Top Financial Performers

$/kWh



This graph demonstrates each systems value of solar (VOS). The value of solar is a per kWh expression of the 30-year monetized value of energy production generated by a solar array.

Project Summary



SECTION 2

Project Overview

Project Overview

Overview

BACKGROUND

In May 2021, the Milwaukee County Board passed a resolution committing to the Paris Climate Agreement: **Reduce County emissions from operations by at least 50% by 2030 and achieve carbon neutrality by 2050 while creating green jobs for people of color that pay livable wages**. As a result, the County continues to explore its options to embrace renewable energy applications where technically feasible and fiscally advantageous.

Considering once-in-a-generation funding for renewable energy made possible by the Federal Inflation Reduction Act (IRA), investment in renewable energy systems has never been more fiscally advantageous for local government entities. The IRA made available tax benefits once reserved only for tax-paying entities, now extended to public entities in the form of the Direct Pay Program.

While constructing the County's new Department of Health & Human Services (DHHS) and Coggs Administration building in 2024, the County sought feedback from both the owner's representative for the project, Concord Group, and engineering firms, TLC and K. Singh & Associates. Although solar feasibility was determined as possible, County staff was tasked by the Community, Environment and Economic Development Committee to verify which properties County-wide are best positioned for onsite solar energy system applications considering a variety of criteria (File No. 24-566). By taking a broader look at all potential projects' benefits, an equalized assessment can be made, comparing each potential project to other opportunities across the County.

MCKINSTRY AS A PARTNER

In June 2024, the Facilities Management Division and the Office of Sustainability engaged McKinstry as a trusted partner to address the requests outlined in File No. 24-566. McKinstry was uniquely positioned to assist in this effort due to specialization in design and construction management of renewables and energy efficiency projects in addition to other capital planning and high-performing facility consultation.

McKinstry has in development and constructed more than 250MW of solar energy systems around the country. This experience equips McKinstry with relevant knowledge about available technologies, emerging trends, pricing, supply chain nuances, consultation and project management. Access to this data made McKinstry uniquely positioned to support the County's evaluation of these options.

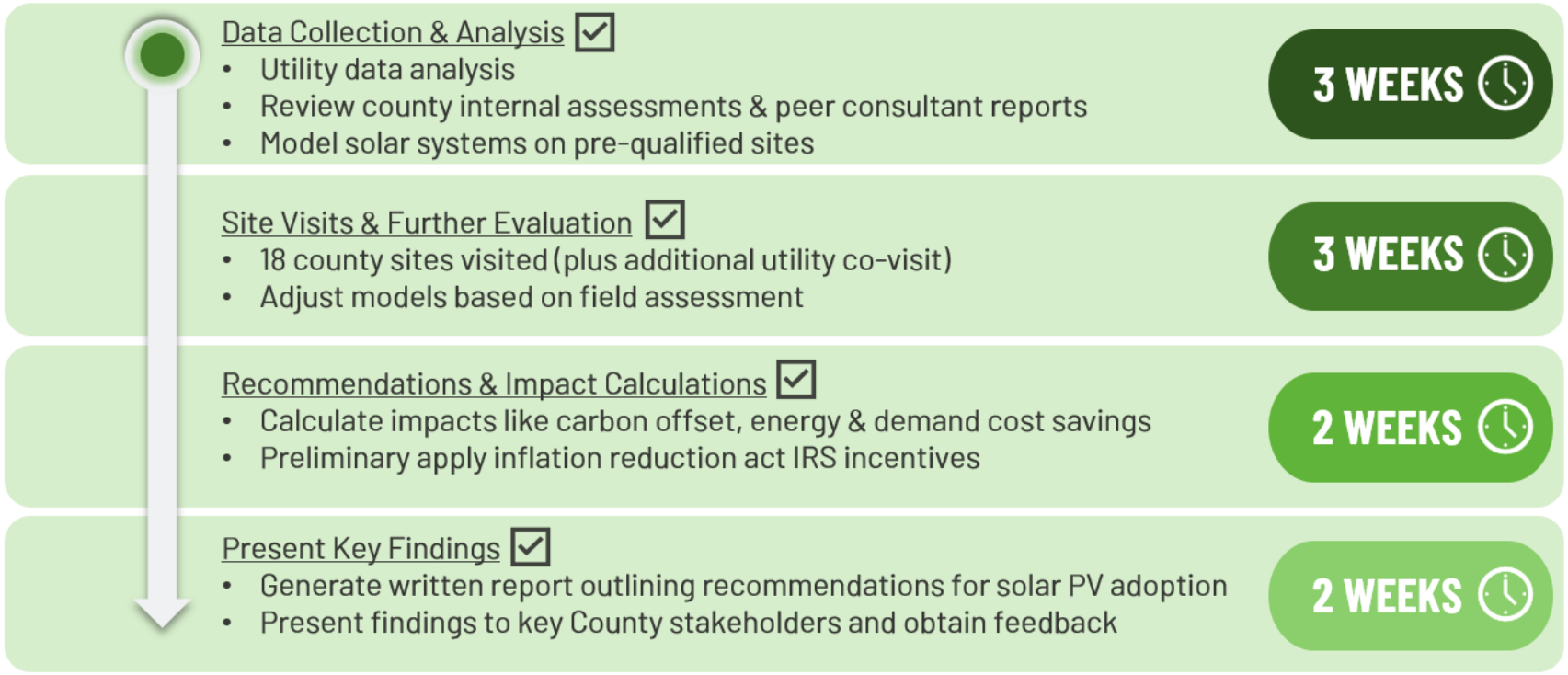
Key Outcomes

- Reduce carbon footprint from County operations using renewable energy generation.
- Ensure fiscal due diligence by evaluating all potential solar investments County-wide.
- Obtain a prioritized list of potential solar projects for County short and long-term planning.
- Consider type of solar projects feasible at a given site (e.g., carport, ground-mount, roof-mount).
- Begin partnering with We Energies to explore flagship projects and other ways of using renewable energy to maximize fiscal and carbon reduction benefits
- Understand how to maximize available funding from local, state and federal sources.
- Gain a high-level understanding of potential investment year-over-year.

Project Overview

SCOPE OF WORK

The scope of work for this assessment focuses on evaluating all County-owned properties across its more than 13 million square feet and numerous land parcels, narrowing properties down to those top 17 sites based on criteria applied to each property. With the assistance of the Office of Sustainability, Parks Department, and other County departments, this effort did not start from scratch. Although all properties were re-assessed as part of the scope of work, the County's preliminary efforts to analyze properties for solar feasibility aided in the analysis of site feasibility and directed focus to properties that were noted as indicative for solar applications, as did the studies performed by outside consultants.



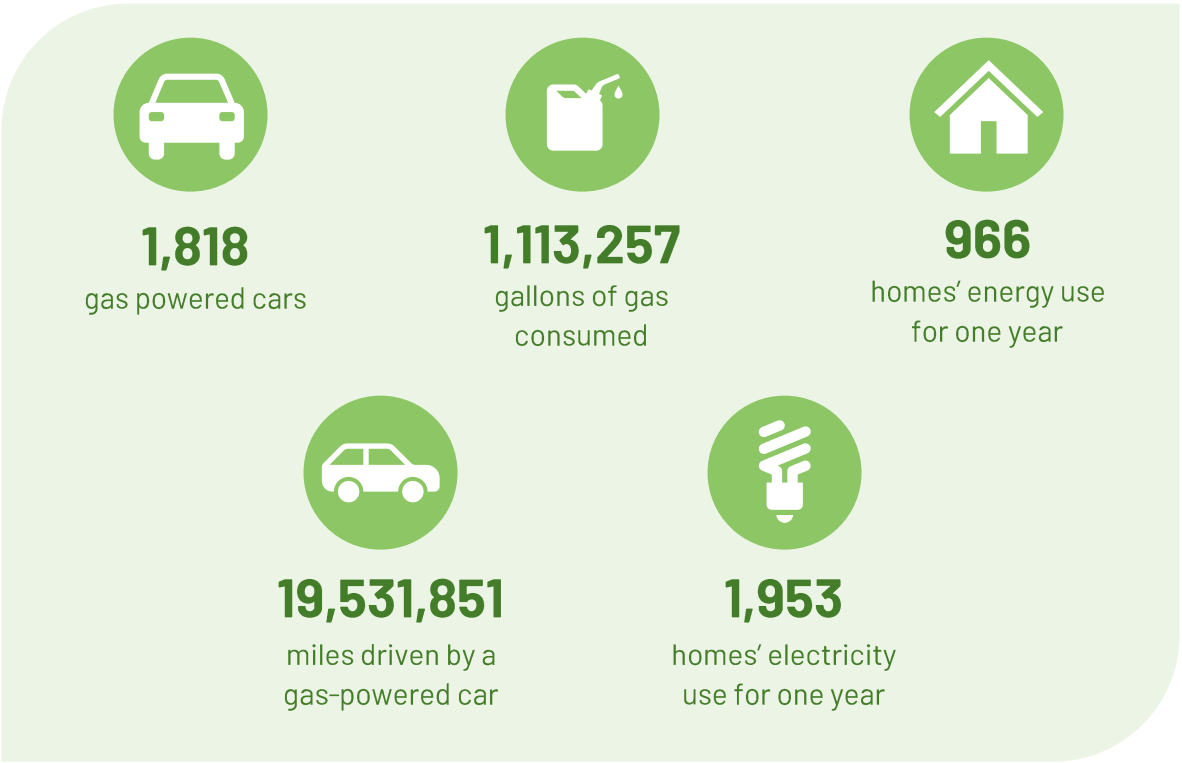
Project Overview

SUMMARY IMPACT TABLE

The table below represents the total potential impact if the County were to immediately implement all recommended projects, or the 22 systems proposed for the 17 sites detailed on a system-by-system basis in the *Site Evaluations* section. While simultaneous implementation of all proposed systems is unlikely, there is an opportunity cost to delaying adoption. As solar PV equipment becomes more economical and less reliant on state and federal subsidies to create compelling economic cases for adoption, less incentives will be available to reduce first costs.

For instance, Focus on Energy, under the authority of the Wisconsin Public Service Commission (PSC), manages various incentive programs for energy efficiency and renewable energy projects across the State. In the last fourth months, maximum available incentives for solar PV projects have decreased by half from $50,000 per project to $25,000 per project. On the other hand, some incentives at the federal level have mainstays exceeding the next several years, such as the Inflation Reduction Act (IRA) Direct-Pay Program. This program that can provide as much as 30% base incentive (or more than 60% including various bonus categories) of eligible project costs in a reimbursable, direct payment to the County is in effect at current values until 2032.

Other factors, such as increases in utility costs and energy commodities like electricity are less predictable, but according to historical data, can conservatively be estimated at 3-6%. Installing solar PV systems to produce energy independently of purchasing retail electric from the utility serves as hedge again rising utility costs. Another key opportunity cost is that of carbon. Carbon emissions from conventional fuel sources powering County operations cannot be undone. If the County implemented the recommended systems outline in the following section, *Site Evaluations*, the carbon offsets in Year 1 would be equivalent to the following:



Project Overview

PROJECT IMPACTS SUMMARY – ALL FEASIBLE SITES		
Cumulative System Statistics		
Total Number of Proposed Systems	22	
Rooftop Systems	11	
Carport Systems	9	
Ground-Mount Systems	2	
Total Number of Sites for Proposed Systems	17	
Total Systems Size	11.196 MW_{DC}	8.559 MW_{AC}
Inflation Reduction Act (IRA) Designations		
Low Income Bonus Eligible Systems	13	
Energy Community Bonus Designated Sites	5	
Economic Assumptions		
Utility Rate Escalator (%)	3.0%	
Initial Cost & One-Time Savings/Incentives		
Estimated Total Implementation Cost	$44,899,695	
Operating Expense[8]	$783,750	
Average System Cost per Watt[9]	$4.01 ($2.90 after incentives)	
Estimated FOE Incentives	$340,922	
Estimated IRA Incentives[10]	$14,281,993	
Annualized Statistics		
Annual Electric Usage of Recommended Sites	37,829,144 kWh	
Annual Production of Proposed Systems	14,162,113 kWh	
Year One Energy Production Value	$1,272,862	
Value of Solar ($/kWh) – Year One	$0.096	
% Electric Usage Offset	38%	
Carbon Offset – Year One	7,682 $MCTCO_2e$	
Lifetime (30-Year) Statistics		
Lifetime Utility Savings	$55,748,685	
Cumulative Net Cashflow	$22,545,855	
Carbon Offset	214,519 $MCTCO_2e$	
Value of Solar ($/kWh) – 30-Year Levelized	$0.1410	
Return on Investment (ROI) – Median	69%	
Payback Period (Years) – Average	20	

[8] One-time inverter replacement costs.

[9] Cost per Watt noted after incentives includes IRA Base Incentives assuming tax-exempt financing, non-competitive IRA bonuses, FOE incentives.

[10] Includes IRA Base Incentives assuming tax-exempt financing, non-competitive IRA bonuses, FOE incentives.

Project Overview

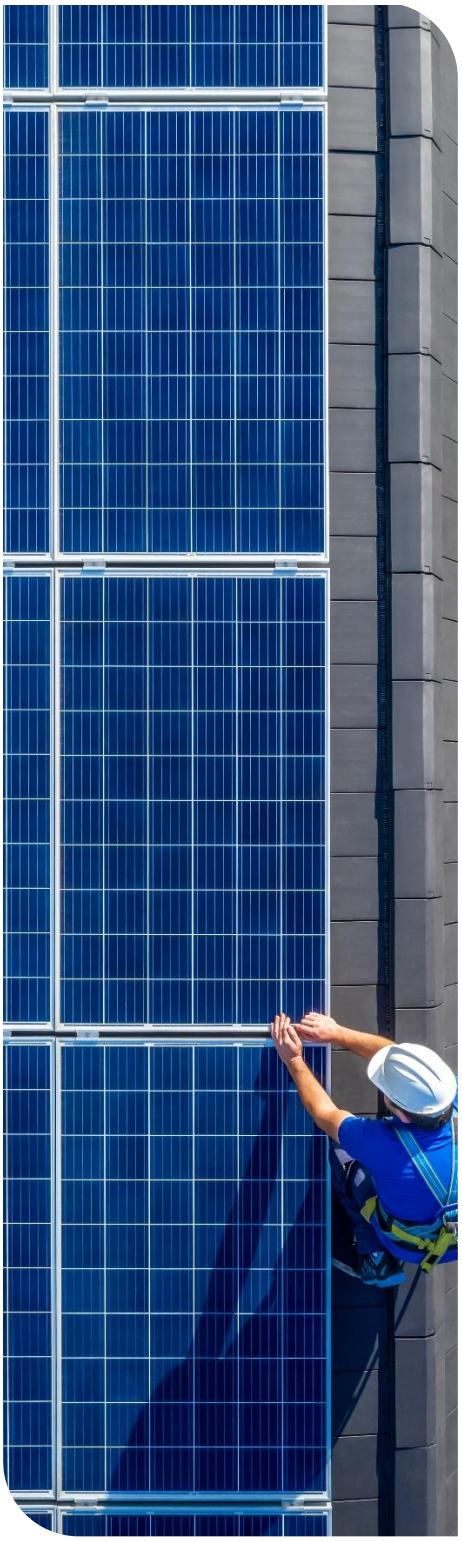
SITE RISKS

RISK	DESCRIPTION	MITIGATION PLAN	RISK LEVEL
SITE CONSTRAINTS - CARPORT AND GROUND-MOUNT	Sub-surface geotechnical conditions, watershed proximity, planning and zoning, easements, and other risks often require more due diligence than a desktop review to fully mitigate development and constructability risks.	During the development phase, additional records and engineering reviews are performed to validate assumptions and uncover risks that may contribute to sites being not constructable without significant costs.	HIGH
SITE CONSTRAINTS - ROOFS	Roof age, condition, structural capacity, wind shear, and planning and zoning are risks that often require more due diligence than a desktop review to fully mitigate development and constructability risks.	During the development phase, additional records and engineering reviews are performed to validate assumptions and uncover risks that may contribute to sites being not constructable without significant costs.	HIGH
INTERCONNECTION UPGRADES	When substantial solar PV energy generation is added to a site, utilities may require utility-side service upgrades that are not determined until well into the interconnection engineering reviews or studies.	Submit interconnection applications early in development phase and, when possible, secure approved interconnection agreements from the utility (which will include required utility service upgrades and costs.	HIGH
DOMESTIC CONTENT AVAILABILITY	Availability of domestic content solar equipment has limited availability in the US market.	Consider the IRA domestic content 10% bonus as an added value gain, rather than expected future project revenue.	MEDIUM
COST UNCERTAINTY	Labor, materials, and services often have limited price certainty beyond 30 business days.	McKinstry's preliminary report pricing (+/- 30%) is based upon completion of a desktop review, assumes a construction start date of Q2 2025.	MEDIUM
INFLATION REDUCTION ACT GUIDELINES	New IRA proposed guidelines continue to be released monthly, creating nuances and uncertainty until guidance is finalized.	McKinstry partners with Ryan LLC to ensure our clients have access to the leading energy tax consultancy firm in the nation. At Ryan, team members actively monitor newly released guidance to assimilate new information used to educate and inform our clients.	LOW
PROJECT LOGISTICS	Project planning is essential while constructing solar PV arrays that may impact the public and County operations.	McKinstry works will work closely with the County, subcontractors, and regulating entities to ensure that construction of future solar PV projects create minimal disruption.	LOW

SECTION 3

Understanding Solar Photovoltaic (PV) Systems

Understanding Solar Photovoltaic (PV) Systems



Why Solar PV for Milwaukee County?

Energy use from buildings accounts for a significant portion of the County's overall carbon footprint – approximately 63% in 2022[11]. This means that one of the key factors to reducing the County's operational carbon emissions to reach its goal of carbon neutrality by 2050 is to reduce the amount of energy used by County facilities. Efforts to decarbonize should always start with low and no cost options for energy reduction like occupant behavioral change programs, scheduling changes to heating and cooling, and other efforts used to drive down energy consumption. This concept of leading with energy use avoidance and reduction is reinforced in the County's Climate Action 2050 Framework in reference to a 2021 World Wildlife Fund paper[12]. In combination with other capital investments like installing high efficiency major building systems or producing energy from renewable sources that have low or no carbon emissions is a key strategy to reducing or eliminating carbon from operations.

There exists an ever-growing list of renewable energy technologies from solar PV to wind turbines and hydroelectric. The world is adopting these systems at unprecedented levels, including Wisconsin. Over the past 3 years, Wisconsin has seen solar PV installed capacity increase more than nine-fold[13]. Solar PV is one of the most cost effective commercial renewable energy applications available in the Midwest with more than $2.7 billion[14] invested in solar energy in the State of Wisconsin alone. In the last 10 years[15], solar PV costs have declined by 43%. In combination with local, state and federal incentives, solar PV has become even more attainable. For these reasons, solar PV is the primary energy source evaluated as a means of making marginal impact on overall County carbon emissions.

WHAT IS NET METERING?

Think of net metering as 'rollover minutes' or 'rollover data' for energy. Net metering allows residential and commercial customers who generate their own electricity from solar power to sell the electricity they aren't using back into the grid. Many states have passed net metering laws. In other states, utilities may offer net metering programs voluntarily or because of regulatory decisions. Differences between state legislation, regulatory decisions and implementation policies mean that the mechanism for compensating solar customers varies widely across the country.

[11] Milwaukee County 2022 International Council for Local Government Initiatives (ICLEI) data.

[12] Milwaukee County Climate Action 2050 (CA50) Framework.

[13] SEIA (2024). *State Solar Spotlight: Wisconsin.* Accessed on 8/2/2024 from www.seia.org.

[14] Clean Grid Alliance (2022). *Solar Power in Wisconsin.* Accessed on 8/2/2024 from www.cleangridalliance.org.

[15] SEIA (2024). *Solar by State: Wisconsin.* Accessed on 8/1/2024 from www.seia.org.

Understanding Solar Photovoltaic (PV) Systems

In We Energies territory, the utility serving all primary County facilities, net metering is possible thanks to Wisconsin State legislation and utility policies[10]. This means that Milwaukee County can, in some cases, be compensated for any excess energy produced by a solar PV array located on County property. However, designing a solar PV system so that it will create the optimal financial and environmental benefits for the County isn't so simple.

For example, solar PV systems sized over $1MW_{AC}$ do not qualify for net metering compensation by We Energies. This means if a building uses less than the system produces on a given day, the excess power is sent to the utility and the County does not get compensated for the exported power.

However, if the system is sized at less than $1MW_{AC}$, excess electricity generated by County will be compensated by We Energies at rates less than the retail value using a bi-directional metering system described in the "How do solar photovoltaic (PV) systems work?"

The amount of compensation the County may receive depends greatly on the amount of electricity being exported to the grid, as described above, and the time of day the electricity is sent back to the grid. This concept is further explained in the next sections, **"How do you right-size a solar PV system?"** and **"What are time-of-use (TOU) utility rates?"**

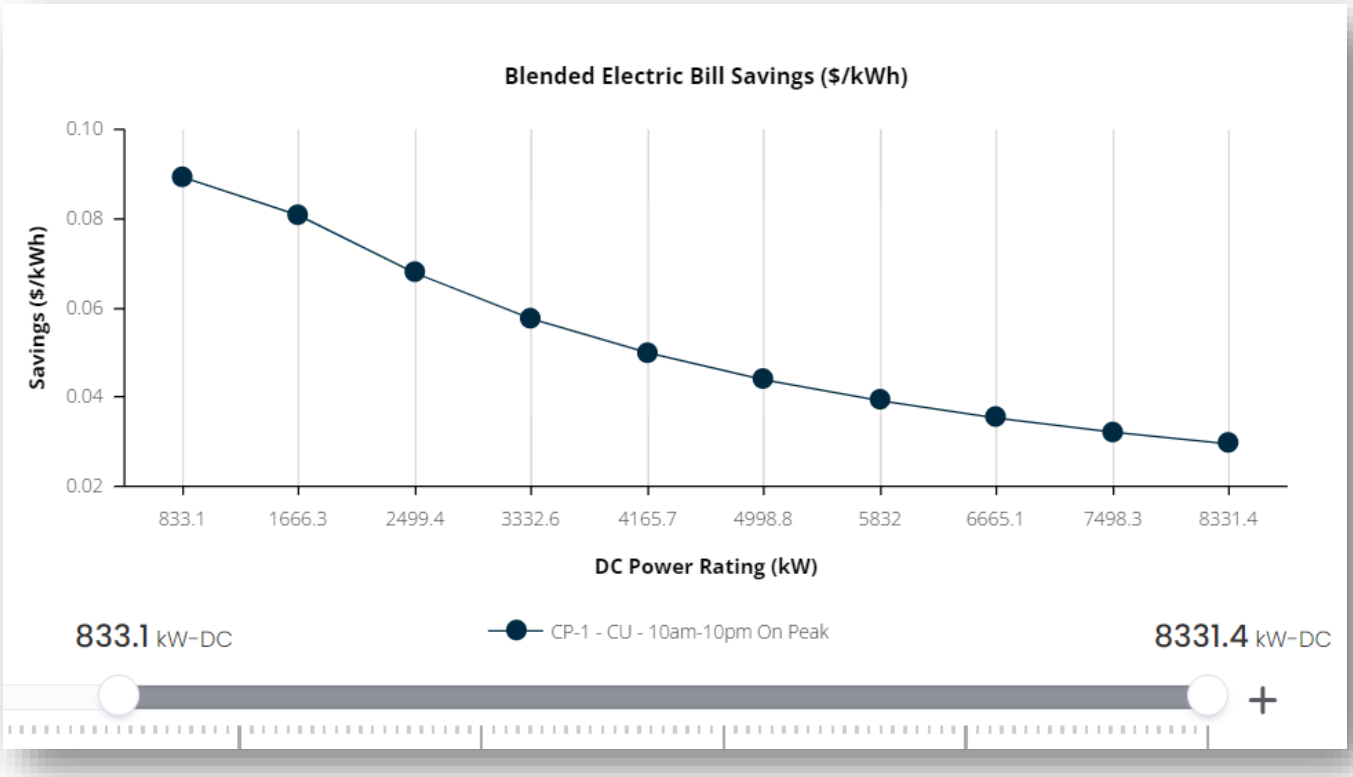
Understanding Solar Photovoltaic (PV) Systems

HOW DO YOU RIGHT-SIZE A SOLAR PV SYSTEM?

For purposes of understanding, identifying the optimal size of a solar PV system differs from site-to-site, year-to-year, etc. In the case of Milwaukee County, system size is determined greatly by the amount of electricity used or demanded by that building at varying times of the day over the course of 12 months. The majority of County buildings are currently set on time-of-use (TOU) rate tariffs – basically, the County pays for electricity based on how much electricity is used at a certain time of the day. For more information on these rates, see **"What are time-of-use (TOU) utility rates?"**

To put it simply, the utility uses TOU rates to cover costs when electricity is expensive, typically when demand across the area is high for electricity (AKA "on-peak"), like on a hot summer day. Conversely, electricity is much less expensive when demand is low (AKA "off-peak"), like on tepid cloudy days or late at night. The utility retail rate of electricity at varying use times is directly related to how much the County could potentially receive in payment for eligible solar PV systems' electricity exports. This direct relationship makes rationale sense: energy produced and sent back to grid is worth more to the utility when they have a lot of customers who want to buy electricity at that time. When energy availability is plentiful and the utility has plenty availability for its users, there is little incentive to purchase electricity from other producers, like a Milwaukee County solar PV array.

Milwaukee County seeks to be a fiduciary administrator of tax-payer dollars in fulfillment of the policies and programs set forth by County Board officials in representation of their constituents. Efforts to decarbonize the County's operations by 2050 require adherence to these policies. They also require investment. Accurately sizing solar PV systems, as described above, involves energy modeling and analysis of utility data, including usage patterns and demand profiles.

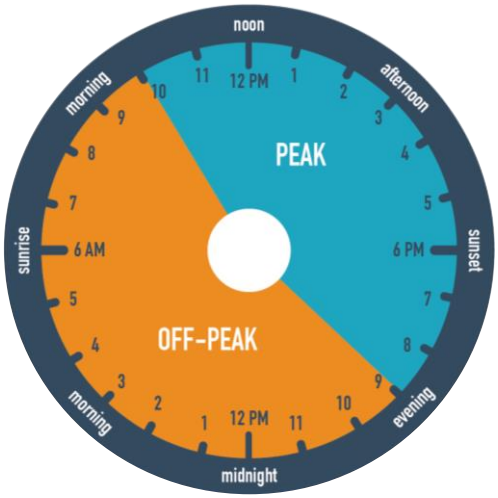


This is one of the key motivating factors behind involving specialists to assess this data so that preliminary assessments of potential solar PV applications can be made. As part of this study, each of the buildings that met preliminary evaluation criteria were then assessed for usage patterns and basic technical feasibility standards like structural capacity for rooftop applications or flood plain mapping for ground-mount systems.

During this analysis period, each site was modeled for solar PV, often in a variety of potential designs to identify which size system matched that building's load profile (AKA how and when that building used electricity over the year) to create the greatest amount of carbon emission reduction while still maintaining the highest possible value of solar per watt. These sites and systems are overviewed in the *Site Evaluations* section. For this reason, there may be some proposed systems that, at a glance, seem illogical, such as those in which only part of a rooftop is contains solar modules, or in some cases, why a large facility is paired with a smaller array, or vice versa. All proposed systems were sized to optimize value obtained per dollar spent or per watt produced.

WHAT ARE TIME-OF-USE (TOU) UTILITY RATES?

Time-of-use (TOU) utility rates are just as they read – utility rates based on the time of day that energy is demanded. Milwaukee County's We Energies electric service is based on these TOU rates. In brief, the more electricity that is demanded during periods of overall high demand, such as a hot summer day, the more expensive that electricity becomes. The opposite is also true, at times when the overall utility territory's demand for electricity is low, the cost of that electricity is lesser. It is critical to understand TOU utility rates within the context of on-site electricity generation because these rates are one of the most critical factors in calculating how economically feasible these systems are.



For instance, a solar PV system that helps offset usage at the highest use, or peak, times of the day, helps offset the most carbon emissions and electricity costs. However, solar PV systems that produce electricity above and beyond what a building demands means, that the utility may purchase back that electricity and use it to fulfill the electric demands of other customers. Instead of this solar energy offsetting high-cost electricity onsite for the building its intended to serve, this excess electricity is purchased at rates prescribed by the utility, typically far less than the costs offset by systems sized to optimally meet the usage of its host site with minimal export.

While it may seem that electricity produced during peak TOU would yield high compensation for exports, peak usage is only defined by a short period of time, typically during the middle of the day when buildings are occupied and performing their intended functions. Imagine this concept as a bell curve with the middle of the day being the apex of the bell. This peak coincides with the highest level of production for solar energy systems and the highest use of that electricity by the building it serves. Excess production from solar energy systems is often produced in the greatest amount throughout the times of the day when less electricity is demanded, or off-peak times. These off-peak times typically offer the least amount of compensation for exported electricity. Taken as an average, solar PV systems that export large amounts of energy to utility often create less value overtime because of the lower compensation received the more excess energy exported. As part of this study, TOU rate schedules were analyzed in detail to best understand how the economics of proposed solar PV systems were impacted. For more information, please refer to the, **"How Do You Right-Size a Solar PV System?"** section above.

SECTION 4

Project Parameters

Project Parameters

Inclusions, Exclusions, Assumptions

GENERAL ASSUMPTIONS

- ***Carbon reduced per kWh*** generated by solar photovoltaics (PV) compared to grid energy purchased in We Energies territory 0.8 lbs CO2e/kWh[16]. This value is determined using We Energies 2023 figures pursuant to U.S. Environmental Protection Agency mandatory Greenhouse Gas Reporting Program regulations under 40 Code of Federal Regulations (CFR) Part 98.
- ***Structural capacity*** – Rooftop solar PV arrays add weight, or load, to the structure's roof on which they are installed. For those sites that were identified as optimal for solar applications, further structural engineering review will be verified in future design efforts should a project be pursued for implementation.
    - For ballasted systems, or systems held in place using weighted blocks, an average of 4-6 pounds per square foot (psf) is typically added to the structure's roof. Building height, wind speed category, building classification, number of blocks, array layout and roof type are all factors in how much capacity is required for a system.
    - For mechanically attached systems, or systems attached to a roof using penetrative attachments, an average of 2-4 psf is typically added to the structure's roof. Building height, wind speed category, building classification and array layout are all factors in determining how many mechanical attachments are required for the system.
- ***Attachment methodology*** – Ballasted racking design with minimal mechanical attachments is to be assumed for all potential rooftop systems. Additional structural reviews will be performed during the final system design, which may identify the need for mechanical attachments.
- ***Roof type and warranty*** – Roofs at each site are assumed to be under warranty and a roof replacement was not factored into the pricing but will be noted as a prerequisite to installation in the "Site Specific Considerations" portion of each site profile provided herein.
- ***County Project Team*** – Throughout this study, there is reference made to "the County Project Team," which is inclusive of Stuart Carron, Director of the Facilities Management Division, and Grant Helle, Energy Program Manager and Interim Director of the Office of Sustainability.

TECHNOLOGY ASSUMPTIONS

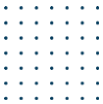
The equipment summarized below was selected by McKinstry based upon each manufacturer's quality, reliability, and market availability, and was used in our energy production and financial modeling analysis to calculate potential costs, savings, and carbon reductions. Products illustrated in this report are subject to change based on future design efforts, supply chain constraints and product availability.

- ***Solar PV –*** Solar PV systems consist of cells composed of semiconductor materials that when exposed to sunlight create an electrical charge that can be converted from alternating current to direct current electricity used to power various building systems.
- ***Rooftop PV System Racking and Attachment –*** For all proposed rooftop solar PV systems, a ballasted racking system was assumed wherever possible, which uses concrete cinderblocks to weigh down solar panel mounting frames as opposed to mechanical attachments that are permanently affixed to the roof using penetrative methods. If there were instances during the study that a feasible site was identified, but

[16] We Energies (2024). *EPA Greenhouse Gas Reporting and Emission Rates.* Accessed 8/2/2024 from www.we-energies.com.

does not have capacity for additional rooftop load, those details will be noted in that site's specific profile in the Findings section.

- ***Solar Modules –*** The proposed systems have been designed using Hanwha Q-Cell Bifacial PERC Half-Cell, 590 monocrystalline, 156 cell modules with 21.7% efficiency. Hanwha is a global leader in the solar industry and one of the world's largest producers of photovoltaics with top quality solar products and services. Modeling performed using these modules should not serve to as a recommendation for future material procurement; future updates to models provided or new modeling efforts may use different equipment specifications.
- ***Inverters –*** The proposed systems are modeled using various sizes of SolarEdge inverters. SolarEdge is a leader in the industrial electrical equipment and clean energy field and has shipped or deployed over 53.6 gigawatts worldwide. Their products have been deployed in more than 140 countries and regions, including the U.S, Europe, and Asia. Modeling performed using these inverters should not serve to as a recommendation for future material procurement; future updates to models provided or new modeling efforts may use different equipment specifications.
- ***Data Acquisition System –*** Proposed systems assume use of a Data Acquisition System (DAS), which provides a complete PV monitoring solution that delivers real-time operational views of the entire system. This software offers a secure solution that immediately detects any problems in a PV installation, with immediate, automated alerts to minimize downtime. These software packages feature user-friendly graphing and modeling capabilities that enable detailed analysis of real-time and past performance.
- ***Battery Energy Storage Systems*** – Battery Energy Storage Systems (BESS) coupled with solar PV can store excess solar electricity for use when solar resource is not available, providing economic and resiliency benefits. There are several different types of BESS that can be used depending on the application. For this study, Socomec Sunsys HES L lithium-ion batteries were optimally sized for each system to determine the maximum amount of economic benefit. These batteries have the capability of customization for any buildings load profile by optimizing through solar PV with self-consumption, peak shaving or backup power.
- ***System Tilt*** – Depending on the type of system installed, the tilt of the module varies to achieve the most efficient solar PV system. For this study, rooftop systems are modeled using a 10-degree tilt, carport systems a 7-degree tilt and fixed ground mount systems a 30-degree tilt. Ground mount tracking systems are not set to any specific tilt, rather, they change position continuously throughout the day to track the sun and capture the highest amount of solar irradiance.
- ***Annual Degradation*** – As with all equipment, solar PV modules become less efficient over time as they are subjected to the elements. The systems modeled here incorporate a 0.5% module degradation, each year, to account for expected production losses.
- ***Operations & Maintenance*** – Equipment like inverters that have a useful life (approximately 10-12 years) less than the useful life of the solar PV modules. Inverter replacement costs are factored into the cost estimates provided in the *Site Evaluations* section. Operations and maintenance (O&M) agreement costs for proposed systems are also included in the estimates provided for an initial three (3)-year period. Future discussions regarding pricing solar O&M services into estimates for 30 years will require input from County decision-makers.
- ***Useful Life of Major Equipment*** – The major equipment of the proposed solar PV systems and their Associated useful lifespan of the equipment specified in this study is as follows and may be used as general references for purposes of understanding.
    - Modules: Performance warranty of 25 to 30 years
    - Inverters: SolarEdge has an extendable warranty of 20 to 25 years



  - Racking: Limited product warranty of 25 years
  - Battery Energy Storage Systems: Extended warranties range from 5 to 15 years

- ***Equipment Quality*** – Only Tier 1, investment-grade equipment is recommended for consideration in future projects because it comes with the industry's most robust warranties and undergo rigorous durability and production testing.

INFLATION REDUCTION ACT (IRA) ASSUMPTIONS

Under the Inflation Reduction Act (IRA), tax-exempt entities can now take advantage of specific tax credits for the installation of renewable technology through Direct Pay. There is the potential for increased monetary incentive for projects that utilize domestic content (i.e., Domestic Content Bonus), are located in U.S. Department of Energy (U.S. DOE) designated Energy Communities (i.e., Energy Community Bonus) or are identified as Low-Income communities (Low-Income Bonus), when certain eligibility requirements are met[17].

- **Direct Pay** – is a mechanism that allows tax-exempt entities that would otherwise be unable to claim certain tax credits eligible to benefit for specific clean energy tax credits. A tax credit is a dollar-for-dollar reduction to your tax liability. Projects that comply with labor requirements, see the section *IRA Explained* for further details on labor requirements, or projects are under 1MW$_{AC}$ are eligible to receive a 30% direct pay payment.
- **Labor Requirements** – to receive the 30% direct pay rate, systems > 1MW$_{AC}$ trigger labor requirements including prevailing wages, apprenticeship, and construction timeline requirements. If labor requirements are not met, the project will only be eligible for 6% base credit (see in Appendix - Labor Requirements for IRA Programs).
- **Domestic Content Bonus** – is an additional and stackable 10% bonus credit for projects using domestic content products (see in Appendix – Is Domestic Content a Bonus Credit or Required).
- **Energy Community Bonus** – is an additional and stackable 10% bonus credit available to sites located within eligible locations.
- **Low-Income Bonus** – is an additional and stackable 10% competitively awarded bonus credit available to sites located within eligible locations.
- **Tax-Exempt Financing Reduction** – projects using tax-exempt financing will reduce the aggregate ITC payment by up to 15% using the calculations as follows:
  - 30% Effective Rate (base): Is calculated as a 15% reduction, or

$$30\% \times (1.0 - 0.15) = 25.5\%$$

  - 40% Effective Rate (base + Energy Community Bonus and/or Domestic Content Bonus): Is calculated as a 15% reduction, or

$$40\% \times (1.0 - 0.15) = 34\%$$

  - 50% Effective Rate (base + energy + low-income): Is calculated at a 15% reduction, or

$$50\% \times (1.0 - 0.15) = 42.5\%$$

[17] IRS (2024). *Credits and Deductions.* Accessed 8/5/24 from www.irs.gov.

Project Parameters

- **Summary Table of Direct Pay Incentives and Bonuses** – Table 1.1 below represents a summary of the IRS Direct Pay incentives and bonuses described above.

DIRECT PAY INCENTIVES & BONUSES				
	Stackable	Competitive	Automatic/ Applied Based on Federal Designation	Reduced if Project Paid Using Tax-Exempt Financing
Direct Pay (Base)[18]	N/A	No	Yes	Yes[19]
Domestic Content[20]	Yes	No	No	Yes
Energy Community	Yes	No	Yes	Yes
Low-Income Bonus	Yes	Yes	No	Yes

Table 1.1

- **IRS 7 Factor Test** – The Internal Revenue Service (IRS) provides guidance for entities evaluating multiple energy properties owned by a single entity. The IRS uses a 7 Factor test to determine whether the IRS will define energy projects as individual properties (many projects, each of which separately applies to the Direct Pay incentives), or an aggregated portfolio (single project, cumulative project specifications applied to the Direct Pay incentives). Due to the complexity of the IRA and IRS rules and guidelines governing applicable energy credits, McKinstry strongly advises the County to engage qualified tax advisory services to fully assess the opportunities and associated risks of the Inflation Reduction Act (IRA). Table 1.2 represents the IRA 7 Factor Test in checklist format. If two or more of the factors are checked as "yes," the systems are considered one (1) singular project. An example is provided below in Tables 1.3 and 1.4.

IRS 7 FACTOR TEST[21]		
Consider the total solar PV portfolio when answering the questions below.	**YES**	**NO**
Contiguous piece of land		
Common power purchase		
Common intertie		
Common substation		
Common permits		
Pursuant single master construction contract		
Pursuant single loan agreement		
****Two (2) or more "YES" factors trigger one energy project treatment from IRS****		

Table 1.2

[18] Base incentive, anything "stackable" stacks on top of this amount.
[19] 15% of 30% in aggregate; not 30% reduced by 15 percentage points.
[20] Highly unlikely due to supply chain issues
[21] IRS (2024). *Definition of Energy Property and Rules Applicable to the Energy Credit.* Accessed on 7/29/24 from www.federalregister.gov.

Project Parameters

EXAMPLE #1

For the example on the right, the following project system is proposed:

A project is sited at a County library. It includes a rooftop solar PV system (500kW$_{AC}$) and a carport solar PV system (700kW$_{AC}$). Both systems are serving the library's electricity demands and are on located on a single property and share the same utility account. Both projects are being built by the same contractor under the same contract.

The example project evaluated above will be evaluated as one system under the IRS Direct Pay program, meaning the combined size of the two systems (1.2MW$_{AC}$) will be used to qualify the project for the various IRS Direct Pay incentives described above and outlined in Table 1.3.

IRS 7 FACTOR[22] TEST: EXAMPLE #1		
Consider the total solar PV portfolio when answering the questions below.	**YES**	**NO**
Contiguous piece of land	X	
Common power purchase	X	
Common intertie	X	
Common substation	X	
Common permits	X	
Pursuant single master construction contract	X	
Pursuant single loan agreement	X	
****Two (2) or more "YES" factors trigger one energy project treatment from IRS****		

Table 1.3

EXAMPLE #2

For the example on the right, the following project system is proposed:

A system is sited at a County museum. It includes a rooftop solar PV system (200kW$_{AC}$) installed this year and serves the electricity demands of the museum. The museum recently acquired an event center on a separate property adjacent to the museum. As part of the renovation to the event center, the County is adding a ground-mount solar PV system (300kW$_{AC}$). The ground-mount system will serve the event center exclusively. While both systems will have been installed by the same contractor, the ground-mount system is being awarded under a separate contract and each property has its own electric account through the local utility. While the rooftop system at the library was paid using general obligation bonds, the ground-mount system is being paid for using a combination of state grant dollars and operating budget funds. Both projects are expected to be operationalized within a few months of the other.

IRS 7 FACTOR[22] TEST: EXAMPLE #2		
Consider the total solar PV portfolio when answering the questions below.	**YES**	**NO**
Contiguous piece of land		X
Common power purchase		X
Common intertie		X
Common substation	X	
Common permits		X
Pursuant single master construction contract		
Pursuant single loan agreement		X
****Two (2) or more "YES" factors trigger one energy project treatment from IRS****		

Table 1.4

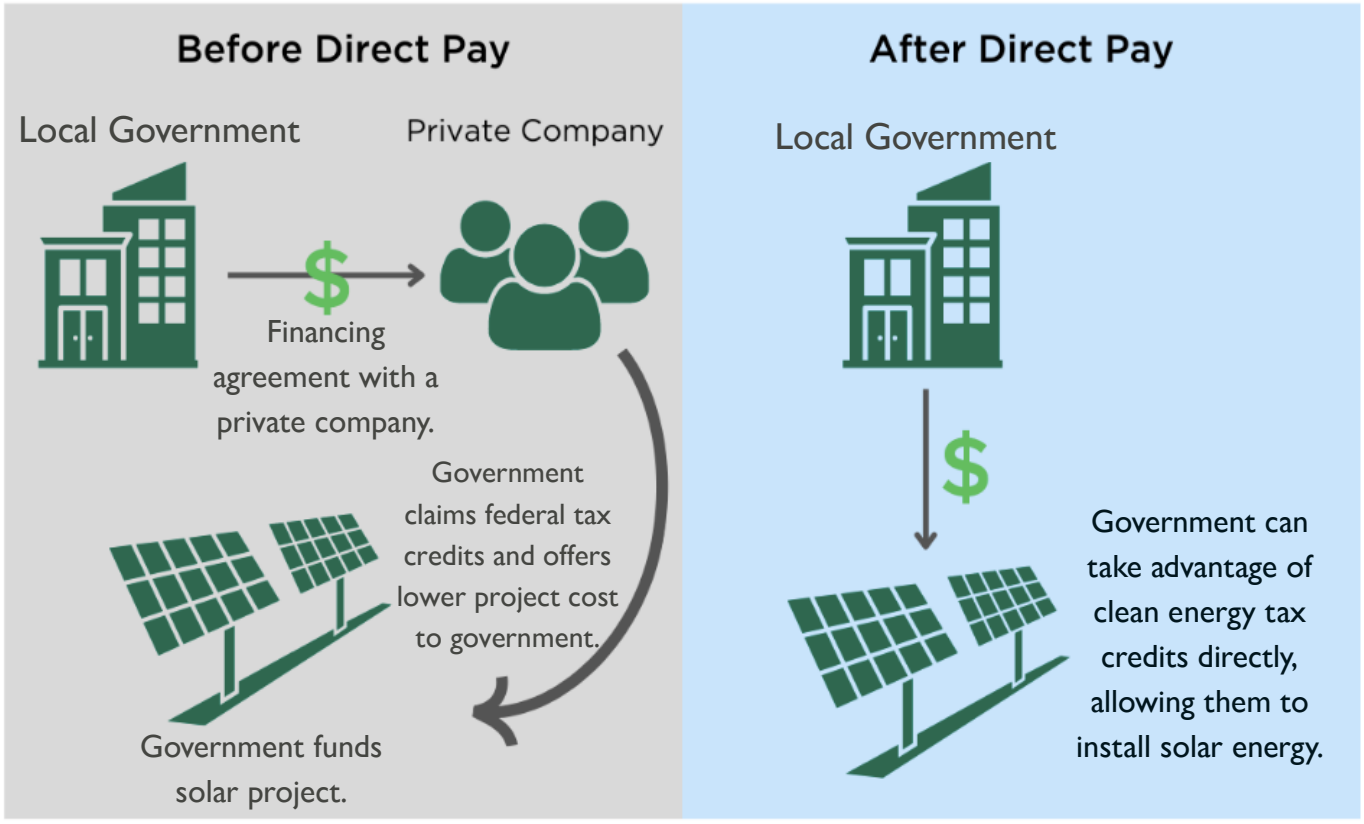
[22] IRS (2024). *Definition of Energy Property and Rules Applicable to the Energy Credit.* Accessed on 7/29/24 from www.federalregister.gov.

Project Parameters

The example project evaluated above would be considered two separate systems under the IRS Direct Pay program, meaning each system will be qualified independently for the various IRS Direct Pay incentives described above and outlined in Table 1.4.

QUICK REFERENCE GUIDE TO IRA CREDITS AND BONUSES BASED UPON SYSTEM SIZE[22]			
SYSTEM SIZE	**<1MWAC**	**>1MWAC**	**>1MWAC**
Direct Pay (Base Incentive)	30%	30%	6%
Domestic Content	10%	10%	2%
Energy Community	10%	10%	2%
Low-Income Bonus	10%	10%	10%
Labor Requirement	No	Yes	No

Table 1.5



Source: Source: Environmental & Energy Study Institute

[22] IRS (2024). *Definition of Energy Property and Rules Applicable to the Energy Credit.* Accessed on 7/29/24 from www.federalregister.gov.

Project Parameters

FINANCIAL ASSUMPTIONS

On-site renewable energy generation will play a significant hedge against future electricity rate increases of the County due to its capacity to both offset future energy consumption (kWh) and mitigate against expected utility cost escalations over a 30-year timeframe. Based upon a review of We Energies electric rates, the blended average electric costs have increased by 19% between 2021 and 2023. McKinstry approached its value of solar analysis in a manner that will maximize the forecasted value of energy from the renewable energy production and result in positive economic impacts to the County's future operating budgets, while also seeking to maximize carbon reductions.

Provide Greatest Value for Least Cost: Decarbonization requires significant investment. To realize the County's goal of reducing net GHG emissions at least 50% by 2030 from 2005 levels and achieving net-zero emissions by 2050, prioritizing how finite County funds are allocated will be important for the County's near and long-term success.

Be Fiscally Responsible: Maximizing the monetized value of the renewable energy generation produced by onsite solar is fiscally responsible and good for all constituents throughout the County.

Maximize GHG Offsets: Maximize high-value energy production ($/kWh) to achieve the highest greenhouse gas emission offset per dollar spent.

Maximize Cumulative Avoided Energy Costs: Each kWh of generated renewable energy production is not monetized equally. Due to utility rate tariffs, energy consumed onsite in real-time often will achieve higher $/kWh value than energy generated that is exported back onto the utility grid.

Use Proven Technologies: Top tier solar modules offer linear production warranties that maintain more than 83% of the original production potential after 25 to 30 years (depending on the manufacturer), creating long-term reliability and predictability in the energy production and economic value of solar investments.

Beyond Simple Payback[23, 24]: Due to the reliability of solar module production potential and the expected escalation of future electricity rates, McKinstry recommends the County not evaluate onsite solar energy investments based upon simple payback, but rather look at the cumulative net cashflow. Reliability in this instance can be attributed to the information provided in the previous subsection above *Use Proven Technologies*. Unlike other energy generation systems, solar PV technology's performance stability is backed by a 25 to 30-year warranty (depending on the manufacturer). This makes the production forecasting low-risk, when calculating lifetime cost benefits as opposed to simple payback as defined below.

$$\textit{Simple Payback} = (\textit{Initial Capital Cost} - \textit{Incentives} + \textit{O\&M}) / \textit{Annual Savings}$$

Cumulative Net Cashflow (Total Lifetime Benefit)[23, 24]: Due to the reliability of solar modules production potential, McKinstry recommends the County evaluate onsite solar energy investments based upon the cumulative net cash flow, which for this study was determined to be measured over 30 years.

$$\textit{Cumulative Net Cashflow} = (\textit{Initial Capital Costs} + \textit{Operating Costs}) - (\textit{Incentives}) / \textit{Cumulative Avoided Energy Costs}$$

[23] Incentives are inclusive of the IRA Base Incentive assuming tax-exempt financing, Energy Community bonus, and FOE incentives. It does not include any competitive bonuses.

[24] Operating costs for the purposes of this study include Year 1-3 O&M contract costs and one-time inverter replacement.

Project Parameters

SCOPE PARAMETERS

- Includes preliminary roof structural assessments for additional feedback on top identified systems. All other structural analyses will be performed outside of this scope as part of future design efforts.
- The cost of this study excludes the cost of interconnection studies, interconnection applications, or additional utility- provided System Impact Studies, if required.
- If interval data is not available, any solar, storage and resiliency recommendations will be based on monthly usage and estimated load profiles. Pricing does not include additional metering to capture interval data.
- Scope assumes detailed review of 10-15 solar sites and 2 storage sites, based on preliminary assumptions.

Ultimately, 22 systems at 17 different sites were recommended.

- Excludes detailed engineering, detailed design drawings, engineered stamped drawings, detailed electrical infrastructure assessment.
- All recommendations will be made according to criteria described in this section.

BASIS FOR RECOMMENDATIONS

Recommendations made throughout this report are based on the following criteria:

- Greatest value for least cost
- Fiscal responsibility of taxpayer dollars
- Reduction of greenhouse gas (GHG) emissions, namely carbon dioxide (CO_2)
- Energy cost avoidance
- Financial viability beyond simple payback looking at cumulative net cashflow
- Location in Low Income or Energy Communities

VALUE OF SOLAR OPTIMIZATION MODELING

Commonly, commercial rate tariffs are monetized using time-of-use (TOU) rates, in forms of peak and off-peak, seasonal, or tiered pricing per unit of energy (kWh) and demand (kW). Solar production (kWh) is monetized most frequently using a TOU rate ($/kWh) measuring consumption against production, with coincidental use being consumed on-site (or behind the meter) and thus monetized at the TOU "retail" value ($/kWh). We Energies values exported energy (kWh) at the avoided cost rate associated with tariffs CGS-CU, which may result in a net reduction in the value of solar as the ratio of exported power increases. This study sought to achieve a target value of solar rate equaling $0.08/kWh or more, while minimizing exported power to less than 30% of total energy production.

SECTION 5

Project Approach

Project Approach

Approach

The study began with an initial kickoff meeting to introduce team members, align on project objectives, finalize the project schedule, establish a communication plan and preferences, identify the target audience, and key aspects of the delivered report and presentation. It was determined that a written report, also available digitally, will be the final deliverable, outlining a prioritized list of potential solar PV systems including ground-mount, roof-mount, and carport types. Each sites potential was be evaluated against a variety of factors described below.

1. DATA COLLECTION & REVIEW

Following the project kick-off meeting, the County shared data necessary to begin feasibility assessment. The goal of this analysis was to identify baseline conditions from which to measure recommendations using the following information:

- Facility Addresses and Gross Square Footage
- Construction drawings for new buildings
- Electricity Utility Bills and future load profiles of new buildings
- Site Plans for each Facility
- County Strategic Plans
- GIS information
- Roof condition & age datasets
- Information on Completed Energy Projects & Audits
- Plans for Future Capital Projects
- Available green space
- Solar Feasibility Studies
- Electrical Drawings/Diagrams
- Structural Drawings and Studies
- Roof warranties

Once the information was compiled, it was reviewed for adequacy to complete this scope of work. Any identified data gaps were reviewed and discussed with the County project team.

WHAT IS THE VALUE OF SOLAR?

The Value of Solar (VOS) is the calculated value of the ($/kWh) cumulative avoided energy costs achieved from the installation of a solar PV array, based upon the net effects in consumption (kWh) (building load) and solar production (kWh) on a time-of-use basis. Factors that impact the VOS rate include tariff rates, TOU consumption and production, and expected future utility rate escalation over 30-years.

The effect to a project's VOS over time, as shown using a 3% annual utility escalation rate demonstrate that a projects year one VOS is $0.09/kWh, while in year 30, the VOS is monetized at an expected rate of $0.2/kWh.

For example, a blended utility rate may = $0.14/kWh, but when generated by an on-site solar PV array, this value may = $0.09/kWh, demonstrating that economically, solar PV in this instance would be a more cost-effective means of energizing a building/site per unit of demand.

2. UTILITY DATA ANALYSIS[25]

Building Base Rate Tariffs

Using actual utility bills, rate tariffs, and data received from the County Project Team and We Energies directly, electric usage was evaluated for each identified County facility. Each site's rate tariffs were reviewed to verify the unit costs and fees associated with electricity consumption and demand. Utility bills provided understanding of the energy cost breakdown, facility type, usage patterns, and more. The County's electric accounts fall mostly between the following two rate structures for electricity consumed on site:

CP -1 – GENERAL PRIMARY SERVICE – TIME OF USE

CG-3 – GENERAL SECONDARY SERVICE – DEMAND/TIME OF USE

Both rate structures are based on the energy time of use, utilizing on-peak and off-peak time periods, where energy consumed during on-peak time periods is more costly compared to off-peak periods. Solar energy production aligns well with the on-peak time periods when we have our highest energy consumption for each facility. This enables the solar PV system to offset the more expensive energy that is being consumed as well as reduce the highest peaks in demand in each of the County's buildings to save money on utility bills.

Solar Rate Tariffs

When solar PV systems are installed, We Energies has two primary different tariffs for the county applications depending on the size and intended purpose of the solar array:

CUSTOMER GENERATING SYSTEMS – CUSTOMER USE (CGS-CU)

CUSTOMER GENERATING SYSTEMS – NON-PURCHASE (CGS-NP)

CGS-CU applies to systems less than $1MW_{AC}$ that are intended to both use and export solar energy to the grid. This tariff provides two separate credits, an avoided energy credit and an avoided capacity credit, that will appear on customer utility bills for any energy that is exported to the utility. The avoided energy credit is intended to provide payment back to the County for any energy sent to We Energies, on a $/kWh basis. The avoided capacity credit is intended to give credit back to Milwaukee County for grid capacity that the utility would otherwise need to provide and is based on the quantity of energy sent to We Energies.

It is important to note that this credit (which varies on and off-peak, and seasonally) pays customers only about 50-66% of their normal cost of electricity.

For systems set up to both use and export solar energy, the combination of credits for exported energy could be considered a revenue source for the department hosting the installation. The value of the credits reflected on the utility bill may in some installations meet or exceed the remainder costs of electricity when the solar array is not productive (i.e. nighttime). Our financial analysis and comparisons take these credits into account but does not provide comparative 'value' of this revenue to a department.

The CGS-NP solar rate tariff is intended for any solar PV systems that are greater than $1MW_{AC}$ where all solar energy produced is used on site and exported power receives no compensation from We Energies. This solar rate tariff is beneficial for large solar PV systems at facilities that have very large consumption loads and will use all of the generated energy from the solar array.

Except for Milwaukee Mitchell International Airport and the Community Reintegration Center, all feasible location options are modeled under the CGS-CU tariff structure.

[25] We Energies (2024). *2024 Electric Rates.* Accessed on 07/31/24 from www.we-energies.com.

Project Approach

TABLES SHOWING RATE TARIFF COSTS

	CP-1	CG-3
On Peak Energy Cost ($/kWh) (Summer)	$0.09444	$0.09057
On Peak Energy Cost ($/kWh) (Winter)	$0.08196	$0.09057
Off Peak Energy Cost ($/kWh) (Summer)	$0.06018	$0.05660
Off Peak Energy Cost ($/kWh) (Winter)	$0.06018	$0.05660
Billed Demand ($/kW) (Summer On Peak)	$20.4340	$18.3130
Billed Demand ($/kW) (Non-Summer On Peak)	$14.7010	$18.3130
Customer Maximum Demand ($/kW)	$2.3110	$3.0750

	CGS-CU	CGS-NP
Avoided Energy Cost Rate ($/kWh) – On Peak Summer	$0.06070	$ --
Avoided Energy Cost Rate ($/kWh) – Off Peak Summer	$0.03162	$ --
Avoided Energy Cost Rate ($/kWh) – On Peak Non-Summer	$0.04320	$ --
Avoided Energy Cost Rate ($/kWh) – Off Peak Non-Summer	$0.03102	$ --
Avoided Capacity Rate ($/kWh)	$0.03452	$ --

The tariff for Customer Generating Systems – Net-Metering (CSG-NM) was evaluated against proposed systems, but offered a lesser compensation for exported electricity than CSG-CU or CSG-NP and therefore is not recommended.

BATTERY ENERGY STORAGE SYSTEMS

To evaluate sites for compatibility with battery energy storage systems (BESS) and further determine potential energy offset impacts of proposed solar PV systems, 15-minute interval data was obtained from We Energies and evaluated against modeled solar performance. Profiles that are favorable for BESS have higher demand charges and are on time of use rates, which are indicative in the rates above, and have various intervals of high peaks in demand throughout the day. Battery Storage, paired with solar PV, can help reduce the peaks in the demand throughout the day by charging the battery from the solar PV array during times of normal or low demand, or when the cost of electricity from the grid is at its least expensive, and deploying the battery during times of peak demand, or when the cost of electricity from the grid is at its most expensive, reducing the amount of energy consumed from the utility and overall energy costs.

3. ESTABLISHING THE PRIORITIZATION MATRIX

With more than 13 million square feet of buildings and tens of thousands of acres of open space, efficiency in analysis was key to maintain reasonable budget and timeline parameters. 401 We Energies electric accounts were screened to determine which accounts had an annual consumption of greater than 100,000kWh. If the account had lower consumption, it was immediately removed from further analysis. Many County sites have multiple utility accounts associated with one property. Thirty-eight (38) individual locations were associated with the utility accounts that passed the initial utility screening, shown in Appendix A. A set of evaluation criteria

was identified to perform comparative analyses of the potential project sites. For the County, the following criteria was applied to these locations:

1. Carbon offset
2. Electric usage reduction
3. Potential rebates/incentives
    - Focus on Energy
    - Inflation Reduction Act (IRA) Direct Pay Program
4. Rooftop development constraints –age, condition, material and structural capacity
5. Total electric demand and load.
6. Ground-based development constraints – planning and zoning, wetland and proximity to electric service
7. Total cost per watt (turnkey installation)
8. Installation / interconnection complexity
9. Alignment with Inflation Reduction Act (IRA) criteria (See IRA section)
10. Proximity of solar PV system to electric load (how close is the proposed system to the need for its energy generation)

4. DESKTOP REVIEW

With the site criteria determined, and utility data analysis completed, the next step was to determine site feasibility for renewable energy for the 38 sites identified. Using the criteria outlined above, the 38 sites were put into a prioritization matrix to compile the top opportunities for solar PV systems for Milwaukee County.

The matrix scoring was based on the parameters shown on the right; these are explained in further detail below.

SCORING CRITERIA	1	2	3
Usage	Low	Medium	High
Roof Age	>15	5-15	<5
Years Until Next Planned Reroof	>5	5	<5
Carbon Offset Potential	Low	Medium	High
System Complexity	High	Medium	Low
Applicable System	Carport	Ground Mount	Rooftop
Option for Rooftop	No	--	Yes
Option for Ground Mount	No	--	Yes
Option for Carport	No	--	Yes
Energy Community	No	--	Yes
Low Income Community	No	--	Yes

MATRIX CRITERIA

Usage: The site was considered high if the annual consumption was greater than 500,000 kWh per year and low if it was less than 200,000 kWh per year.

Roof Age: The roof age is important to note when looking at a rooftop system. If a rooftop was less than 5 years old, it was deemed highly feasible for solar, as the life of the roof is conducive for a 30-year rooftop system without having to reroof within the lifetime of the solar array.

Years Planned Until Next Re-Roof: Upcoming capital projects such as roof upgrades triggered flagging for future conversations with site-specific personnel to better understand how those projects could impact either the design and/or the overall viability of solar PV at that site.

Project Approach

Carbon Offset Potential: The sites that have the highest usage and largest available space will allow for the highest carbon offset in the County. Sites with a usage greater than 500,000kWh and system size greater than 500kW scored high, where sites with usage between 200,000 and 500,000kWh and system size greater than 200kW scored medium. Low sites had usage less than 200,000kWh and a potential system size less than 200kW.

System Complexity: There are many factors to consider when assessing sites for solar systems. Common factors that increase the system complexity include the distance to interconnection and where the array would tie in to the existing electrical system, if there are multiple roof levels or a lot of rooftop units or obstructions for rooftop systems, if mechanical attachments are needed for the roof, if the parking lot has a lot of obstructions or obstacles such as trees, light poles or special landscaping, if the ground is not level, if the site is in a special district or permitting zone such as the airport, if there is special testing needed such as geotechnical studies or x-ray scanning of parking decks, amongst others.

Applicable System: Electrical diagrams, structural drawings, existing capital project plans, geographic information systems (GIS) software were reviewed, along with solar modeling software, to determine which solar applications (rooftop, ground-mount, or carport canopies) were most advantageous at each site.

Options for Rooftop, Ground Mount, Carport: Some sites had the ability to have more than one system type, depending on available roof space, parking lot space, and green space. If there were multiple locations for feasible solar systems, the site gained more points in the scoring matrix.

Low Income and Energy Community: The location of the site was evaluated for additional IRA funding and if they fell into either Low Income or Energy Community areas.

Sites that were identified as most optimal for solar PV system applications, as well as those that required additional verification before feasibility could be confirmed, were scheduled for site visits. Site visits were planned for the following locations:

1. General Mitchell International Airport
2. KK Transit Station
3. Vel Philips
4. Coggs Building
5. King Community Center
6. Noyes Park
7. Milwaukee County Zoo
8. Mitchell Park
9. Kosciuszko Community Center
10. Wilson Senior Center
11. Fleet Garage
12. Washington Senior Center
13. North Shop
14. Hillside Complex
15. Sports Complex
16. Sheriffs Training Academy
17. Community Reintegration Center *(Was visited during a parallel McKinstry project)*

Project Approach

5. SITE VISITS & STAFF INTERVIEWS

The County Project Team coordinated escorted site visits to properties identified during the desktop review. Site visits served multiple purposes as part of the study. One was to gather additional information about existing infrastructure conditions, energy usage, site details and site-specific nuances, etc. The other was to observe first-hand those elements of properties that cannot be obtained from a desktop review, such as:

- Roof characteristics and observed remaining life
- Electrical infrastructure – Determine if the current service has capacity for the proposed solar array.
- Transformer and switch gear locations
- Mapping of relationships between potential solar PV energy systems and multiple loads served
- Changes in landscape or buildings not observed or made after most recently available GIS data
- Proximity of site location to interconnection point for any ground mount arrays.
- Visibility of proposed array locations to the community
- Topography of existing green spaces

These site visits also created the unique opportunity to have additional conversations with onsite staff and stakeholders that may impact recommendations. Some of the questions asked during this interaction included:

- *Plans for expansion or reduction?*
- *Any plans that would alter electric loads? Ex: Adding EV charging*
- *Which specific roof sections were updated?*
- *What utility meters serve which buildings/section of buildings?*
- *What are the green spaces or parking areas specifically used for?*
- *How are the buildings operated – are there time periods where equipment is all started at one time to cause high peaks (BESS question specifically)?*

6. REFINING THE REVIEW

Following site visits, a post-site audit review was held to discuss what was found, what was observed, review the schedule for deliverable completion, and assign tasks required to complete the preliminary recommendation lists and calculations.

The information gathered onsite was used to further refine the prioritization matrix for potential solar PV applications. This process included:

- Having further conversations with the County Project Team to gain clarifications on site location, current building and future development plans.
- Discussing preliminary interconnection and permitting feasibility with the utility and the authority having jurisdiction over the location of the proposed systems
- Right sizing or fine-tuning system models for proposed sites to ensure the greatest economic and environmental benefits

- Conducting more detailed structural reviews for top ranking opportunities - For buildings under consideration for a rooftop system, a preliminary review of the structural capacity was completed to determine if and how much the existing roof had capacity for additional weight from the solar PV system. The amount of available capacity helps identify if a rooftop system can utilize a ballasted system or would need to consider mechanical attachments for the least amount of structural load

To rank these in order of top priority, cost, carbon reduction, and value of solar needed to be integrated together to show the best performing sites and systems. The ratio between the initial cost of the system including FOE and IRA incentives and the lifetime carbon reduction was multiplied by the value of solar for each proposed solar array to reveal the systems that have the highest carbon reduction value per dollar cost as well as the best value of solar. The chart to the right shows the top priority list of solar PV systems in order of best performance financially and the ability to reduce carbon emissions, while having the highest amount of savings per each kWh produced from the solar array.

Additional Considerations

CRITERIA

Deploying solar can be a smart, long-term strategy that reduces utility expenditures and positively impacts an organization's bottom line. Solar buyers today have several funding options to consider including using capital funds, a capital/operating lease, bonding or public-private partnerships.

Understanding the differences, savings opportunity and benefits of each funding option must be a consideration when planning a project. It is important to look beyond a single solution and evaluate all available options to develop a financing solution that aligns with project intent and maximizes the long-term economic impact of the project. Direct ownership almost always provides the best economic returns, but for those that do not have access to capital or tax liability, third-party ownership structures may offer a great no-upfront-cost option.

Based upon discussions with County staff, it is likely that the County will use general obligation (GO) bonds to fund any future potential development and construction of on-site renewables.

AUTHORITIES HAVING JURISDICTION (AHJ) GUIDELINES

Each of the proposed systems is located in one of the four below jurisdictions each with unique ordinances for permitting solar energy systems. As part of this study, preliminary discussions were had with each jurisdiction to assess initial feasibility. The summary of this research can be found below. Overall, all four jurisdictions are considered solar-friendly communities.

1. **City of Milwaukee**

TYPE OF PERMIT REQUIRED

Commercial Solar

[26] City of Milwaukee (2022). *Commercial Solar Permit Process.* Accessed on 07/31/2024 from www.city.milwaukee.gov.

CONTACT
Number: 414-286-8210
Email: planadmin@milwaukee.gov

FEES
Plan Review: $250
Building Permit Fees: $315 X 0.016 + $10
Electrical Permit Fees: $350 X 0.016 + 10

ORDINANCE REFERENCES
Accessory Use Structures - Solar Arrays. A ground-mounted solar array that is more than 20 feet in height shall comply with the setback regulations for a principal building. A ground-mounted solar array that is 20 feet or less in height shall comply with the front setback requirement and be set back a minimum of 1.5 feet from all side, side street and rear lot lines[26].

SUMMARY
The City of Milwaukee is amendable to a variety of solar applications with clear code guidelines. The City's participation in U.S. Department of Energy's SolSmart program means the City is particularly interested in welcoming solar into the community.

2. City of Franklin

TYPE OF PERMIT REQUIRED
Depends on Zoning –

- Accessory structure
  - Permit process:
    - City will inform the County on setbacks – a variance may be needed for ground mount systems depending on location of array to setbacks.
    - No permits are required through the Permitting Department.
    - No specific feedback regarding carports or rooftop systems

CONTACT
Number: 414-425-0084
Email: aschlueter@franklinwi.gov (Aimee Schlueter, Permit Technician)

FEES
No information available. Contact the City for more information.

ORDINANCE REFERENCES
City of Franklin Code references to Wisconsin State Legislature Administrative Chapter SPS 371[27] for Solar Energy Systems. Please refer to these State Codes for future system planning.

[27] Wisconsin Administrative Code (2013). *Chapter SPS 371.* Accessed on 7/30/24 from https://docs.legis.wisconsin.gov/.

SUMMARY

Though non-specific on various requirements, the City of Franklin seems amenable to permitting solar applications.

3. City of West Allis

PERMITTING

- Permitted as an Accessory Use in all zoning districts.
- Apply for a commercial building permit.
- Apply for an electric permit – installer would apply for this.
- If building on a vacant lot, a site plan review would be required.

CONTACT

Number: 414-302-8460

Email: ewagner@westalliswi.gov (Emily Wagner, Planner)

FEES

$300 for any system size above 100kW; other permitting fees may apply.

ORDINANCE REFERENCES

City of West Allis refers to solar energy systems in Section 19.35[28] Accessory Uses of their municipal code, allowing for solar as in Accessory use in all zoning districts.

SUMMARY

The City of West Allis is amendable to solar and no clear barriers to permitting were identified.

4. City of Wauwatosa

PERMITTING

- All permits are submitted using the City's online self-service portal. Permits will be reviewed by the City's Building & Safety Division.

CONTACT

Number: 414-302-8460

Email: ewagner@westalliswi.gov (Emily Wagner, Planner)

[28] City of West Allis (2024). *Municipal Code, Subchapter III Uses, Section 19.35 Accessory Uses.* Accessed on 7/30/24 from https://westallis.municipalcodeonline.com/.

FEES

- Using the City's fee estimator, it is estimated that a Solar Permit[29] would cost less than $200.
- Depending on the system location and type, there is potential need for a Zoning Permit[30] estimated at $1,300.
- An Electrical Permit[30] is almost always required, though cost could not be determined at this time.

ORDINANCE REFERENCES

City of Wauwatosa has detailed information regarding solar permitting. Please visit the following website for more information: https://www.wauwatosa.net/government/departments/planning-zoning.

SUMMARY

The City of Wauwatosa has the most detailed guidelines for permitting and zoning solar energy systems of all the jurisdictions applicable to this study. The permitting process is clear and should be fairly easy to navigate. Overall, the City of Wauwatosa is amenable to solar energy systems.

WE ENERGIES COLLABORATION

As part of the Scope of Work, several discussions were held with We Energies to understand how various utility regulation, rate and renewable energy programs could affect the decision-making process of the County resulting from the recommendations made in this study's findings. These discussions are summarized below.

Renewable Pathway is a program that offers the County access to purchase renewable energy generated from solar farms (Badger Hollow and others) operated by We Energies. Under this program, the County is able to commit to purchase units of energy over a 1 or 5-year term and assigns the renewable energy credits (RECs) to the County. Cost data and detailed terms and conditions are only available through speaking with a We Energies representative directly – there is no public collateral available. It is recommended that the County arrange a meeting with We Energies and perform a cost benefit analysis to determine where it is optimal to install onsite solar generation compared to purchasing units of energy through the Renewable Pathway program.

Energy for Tomorrow like Renewable Pathway, this program provides the County access to purchase energy from renewable resources, the purchased power is Green E certified energy credits (but does not assign associated RECs to the County). Cost data and more information about enrollment can be found in the Appendix.

Land Lease Agreements We Energies will consider land parcels suitable for solar energy development under a land lease agreement. Land parcels of approximately 40-acres that are available for a 50-year commitment (30-year lease, plus (2) 10-year options) could lead to a negotiated land lease agreement between the County and We Energies. If mutual agreement is reached, this land lease option creates a possibility for the County to secure future revenues.

Solar Now: Not available – no longer used.

[29] City of Wauwatosa (2024). *Solar Permitting.* Accessed on 7/30/24 from http://www.wauwatosa.net/.
[30] City of Wauwatosa (2024). *Zoning Permits.* Accessed on 7/30/24 from http://www.wauwatosa.net/.

Project Approach

Other Programs & Pilots: Not available– specific pilots were not identified. However, on a case-by-case basis, these programs may be explored at the time of detailed design in collaboration with We Energies.

WE ENERGIES COLLABORATION CONTRIBUTORS

1. Frances Hardrick - Frances.Hardrick@wecenergygroup.com
2. Doreen Reske - Doreen.Reske@we-energies.com
3. Mary Lemay - Mary.Lemay@we-energies.com
4. Jennifer Szedziewski - Jennifer.Szedziewski@wecenergygroup.com

INTERCONNECTION PROCESS

Navigating utility interconnection processes can be fraught with risks. Failing to accurately perform effective interconnection due diligence often results in unexpected costs after a project has been approved. Interconnection applications are submitted pursuant to Wisconsin Public Service Commission (PSC) Chapter 119 Rules for Interconnecting Distributed Generation Facilities. Part of the Study's efforts included working with We Energies to understand rate tariffs, associated fees, and potential utility system upgrades to interconnect solar PV arrays to their grid.

Below is a summary of interconnection and review process fees, and upgrade costs (if applicable) to secure interconnection approval.

INTERCONNECTION APPLICATION			Commissioning Fees
Category 2	>20kW and <200kW	fee $300 + $10/kW	$250
Category 3	>200kW and <1MW	fee $2000 + $2/kW	$1000
Category 4	>1MW to 15MW	fee $4000 + $0.50/kW	$2500
Fee will be deducted from the Energy Review, if required.			
Engineering Review Fee	All categories are cost based		
Distributed System Study (DSS)	All categories are cost based		

REVIEWING ROOFING WARRANTIES/MANUFACTURER SPECS

For each proposed roof top solar PV system, the warranty documentation for the current roof was reviewed (if available) to evaluate for potential implications of solar PV applications on warranty limitations. For example, some roofing warranties will consider intentional penetration of the roofing membrane, such as for the installation of a mechanically attached solar PV system, to void the warranty of the current roofing system. This is one reason why ballasted rooftop solar PV systems were used as one of the assumptions for this study. However, due to wind shear, weight restrictions or other implications, ballasted solar PV systems for rooftop application are not always possible. In these instances, it is especially important to have a thorough understanding of how future actions could impact existing warranties, including if conversations should be had with roofing contractors or if rooftop solar PV is deemed not feasible at a given site as a result.

Project Approach

BATTERY ENERGY STORAGE SYSTEMS

Battery energy storage systems (BESS) are a new technology designed to allow users to store energy for use at times of the day that create economic benefit (utility bill savings) and/or to provide for resiliency for critical infrastructure assets when utility power is disrupted. Currently, lithium-ion battery banks are the preferred BESS design, which offer users the benefit of scalability in size (kW) and duration (kWh).

When solar PV and BESS are integrated with the existing utility service, they can create a microgrid, a localized and self-contained energy system that can operate independently from the utility.

Economic Benefits

Two common uses of BESS include demand charge management which uses BESS capacity to collect and store energy for dispatch to 'shave' the peak load of a site to lower the $/kW charges). Another common BESS benefit is the concept of, energy arbitrage, whereby the BESS is charged during times of cheap electricity ($/kWh) and dispatching the power during more expensive time-of-use rate periods to reduce overall energy costs. Depending on the load profile, these two uses can be used separately or stacked together to achieve the most amount of savings through the BESS.

Energy Resiliency Benefits

Energy resiliency is a goal many public sectors entities value to ensure critical infrastructure systems maintain operation when utility power failures occur. In recent years, BESS has emerged as a solution that provides short-term, reliable energy in these unfortunate situations.

When necessary, a microgrid can be used to provide synchronized power delivery to facilities critical loads that are essential to maintaining power at community centers servicing local constituents, or 24/7 operational facilities that provide essential services to the community at-large.

SECTION 6

Project Findings

Project Findings

This example table is intended to explain the data fields provided for each Site Evaluation in the *Project Findings* section.

SITE NAME	EXAMPLE
SITE	
PIN	*Property identification number for parcel on which the proposed system is located*
We Energies Account No.	*Electric account number that the proposed system would be serving*
We Energies Rate Tariff	*We Energies rate structure on which electric charges are costed*
Annual Electric Usage	*Annual electric usage based on 2023-2024 15-minute interval data provided by We Energies.*
Roof Material	*Material of roofing that often has implications for how solar is installed*
Roof Age	*Age of roof is a key indicator for whether solar is feasible at this time or may be in the future (e.g., 0-6 years optimal for solar; 7+ years case-by-case basis, not ideal; 20+ unfeasible and roof replacement could coincide with solar adoption for rooftop systems)*
PROPOSED SYSTEM	
Type	*Rooftop, ground-mount or carport*
Size	*Size of proposed system in direct current (DC) and alternating current (AC)*
Estimated Cost	*Estimated (+/-30%) cost to implement proposed system including equipment replacement for those components with a useful life less than that of the system (30-years) and Year 1-3 operations & maintenance agreement.*
Estimated IRA Impact	*Estimated IRA incentive eligibility including base incentive and non-competitive bonus incentives (e.g., Domestic Content, Energy Community) less tax-exempt financing assumption (G.O. bonds assumed as funding for all proposed systems equally reducing all by 15% of 30% base incentive) Base incentive for all Site Evaluation summary tables assumed prevailing wage would be paid for those proposed systems >1MWAC, equal to 30%.*
Estimated FOE Incentives	*Estimated Focus on Energy (FOE) incentive, $50/kW or $25,000 maximum.*
Annual Production	*Annual production of proposed system (this figure represents production of the proposed system in year 1 of operation and for each year after, performance may degrade by an estimated 0.5%).*
IMPACT	
% Electric Usage Offset	*Percent of annual electricity (kWh) for an individual building not needed to be purchased from the grid due to electricity produced from the proposed solar PV system.*
30-Year Utility Savings	*Total inflows - avoided energy costs (demand and commodity charges) over the 30-year life of the proposed system – and outflows – construction and maintenance costs*
Annual Tons of Carbon Offset	*Carbon emissions avoided by generating electricity using the proposed system as opposed to demanding it from the grid – calculated using proposed system production (kWh) for Year 1.*
% County Carbon Offset	*Percent of carbon emissions offset relative to the total carbon emissions resulting from County operations in 2022.*
Estimated ROI	*Cumulative net benefit (total production value over 30-year life of a system) including non-competitive incentives and operating costs divided by the estimated cost of the system. This number also accounts for annual system performance degradation of 0.5% and 3% utility cost escalation and is expressed as a percentage.*
Payback Period (Years)	*Initial investment (less FOE and Direct Pay non-competitive incentives) divided by the annual cashflow. This number also accounts for annual system performance degradation of 0.5% and 3% utility cost escalation and is expressed in years.*
IRA IMPLICATIONS	
Energy Community	*Designation by the U.S. Department of Energy as part of the IRA Direct Pay program. This designation signifies initial qualification for the Energy Community Bonus provided on a non-competitive basis.*
Low Income Community	*Designation by the U.S. Department of Energy as part of the IRA Direct Pay program. This designation signifies initial qualification for the annual Low Income Community Bonus available on a competitive basis.*
Estimated IRA Impact	*Base IRA Direct Pay of 30% plus any non-competitive Bonuses (e.g., Energy Community Bonus) less the 15% aggregate reduction for projects funded using tax-exempt financing (e.g., G.O. Bonds).*
SITE-SPECIFIC CONSIDERATIONS	
• *Pertinent information to site and/or project feasibility.*	

Project Findings

SITE NAME	COMMUNITY REINTEGRATION CENTER – ROOFTOP

8885 S 68th Street, Franklin, WI

SITE		PROPOSED SYSTEM	
PIN	8500003000	**Type**	Rooftop
We Energies Account No.	71233712000014	**Size**	• 479kW$_{DC}$ • 360kW$_{Ac}$
We Energies Rate Tariff	Cp1		
Annual Electric Usage	6,304,393 kWh	**Estimated Cost**	$1,319,100
Roof Material	BUR	**Estimated FOE Incentives**	$23,984
Roof Age	1999	**Annual Production**	596,751 kWh

IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	9.5%	**Energy Community**	No
Annual Tons of Carbon Offset	417 MTCO$_2$e	**Low Income Community**	No
30-Year Utility Savings	$2,946,724	**Estimated IRA Impact**	25.5%
% County Carbon Offset	0.356%		
Estimated ROI	204%		
Payback Period (Years)	12.3		

SITE-SPECIFIC CONSIDERATIONS

- Structural capacity to support proposed system should be further assessed.
- Roof age is significant factor (25 years) – ideal to coincide installation with replacement.
- Electrical capacity as observed should be further assessed for its ability to support the proposed system.
- As part of reintegration programs, having on-site solar generation poses a variety of opportunities for career training and skilled labor development.

Project Findings

SITE NAME	HILLSIDE COMPLEX – ROOFTOP

LOW INCOME COMMUNITY

1525 W Vine Street, Milwaukee, WI

SITE		PROPOSED SYSTEM	
PIN	3512901112	**Type**	Rooftop
We Energies Account No.	71528000700002	**Size**	• 1,071kW$_{DC}$ • 840kW$_{AC}$
We Energies Rate Tariff	Cp1		
Annual Electric Usage	2,409,176 kWh	**Estimated Cost**	$2,732,200
Roof Material	Black EPDM	**Estimated FOE Incentives**	$25,000
Roof Age	2021	**Annual Production**	1,339,331kWh

IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	56%	**Energy Community**	No
Annual Tons of Carbon Offset	646 MTCO$_2$e	**Low Income Community**	Yes
Lifetime Utility Savings	$5,611,959	**Estimated IRA Impact**	25.5%
% County Carbon Offset	0.551%		
Estimated ROI	175%		
Payback Period (Years)	13.4		

SITE-SPECIFIC CONSIDERATIONS

- Structural capacity to support proposed system should be further assessed.
- Electrical capacity as observed should be further assessed for its ability to support the proposed system.
- 2021 ideal roof age.

Project Findings

SITE NAME	MILWAUKEE MITCHELL INTERNATIONAL AIRPORT – GROUND MOUNT - FIXED

5300 S Howell Ave, Milwaukee, WI

SITE		PROPOSED SYSTEM	
PIN	6409999120	**Type**	Ground Mount - Fixed
We Energies Account No.	8761000022	**Size**	• 1,020kW$_{DC}$ • 800kW$_{AC}$
We Energies Rate Tariff	Cp1		
Annual Electric Usage	10,170,651 kWh	**Estimated Cost**	$2,952,700
Roof Material	N/A	**Estimated FOE Incentives**	$25,000
Roof Age	N/A	**Annual Production**	1,352,836 kWh

IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	13%	**Energy Community**	No
Annual Tons of Carbon Offset	946 MTCO$_2$e	**Low Income Community**	No
Lifetime Utility Savings	$5,677,130	**Estimated IRA Impact**	25.5%
% County Carbon Offset	0.807%		
Estimated ROI	158%		
Payback Period (Years)	26.2		

SITE-SPECIFIC CONSIDERATIONS

- The Federal Aviation Administration (FAA) has requirements for solar energy systems installed on/near airport properties that will need to be adhered to in any future design processes.
- Given the critical nature of this site's function, possible microgrid applications using battery energy storage should be considered during design.
- Interconnection route from proposed system to building switchgear needs further exploration.
- System may require setback variances from AHJ.

Project Findings

SITE NAME	VEL R. PHILIPS JUVENILE JUSTICE CENTER – ROOFTOP

ENERGY COMMUNITY

10201 W Watertown Plank Rd, Wauwatosa, WI

SITE		PROPOSED SYSTEM	
PIN	3799999066	**Type**	Rooftop
We Energies Account No.	070730965300042	**Size**	• 275kW$_{DC}$ • 200kW$_{AC}$
We Energies Rate Tariff	Cg3		
Annual Electric Usage	1,779,766 kWh	**Estimated Cost**	$1,033,238
Roof Material	Waterproofing Membrane (EPDM) single-ply	**Estimated FOE Incentives**	$13,777
Roof Age	1994; 2020	**Annual Production**	343,777 kWh

IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	19%	**Energy Community**	Yes
Annual Tons of Carbon Offset	240 MTCO$_2$e	**Low Income Community**	No
Lifetime Utility Savings	$1,659,985	**Estimated IRA Impact**	34%
% County Carbon Offset	0.203%		
Estimated ROI	146%		
Payback Period (Years)	15.2		

SITE-SPECIFIC CONSIDERATIONS

- Structural capacity to support proposed system should be further assessed.
- Roof age is significant factor (30 years) – ideal to coincide installation with replacement. 2020 portion of roof is ideal age.
- Electrical capacity as observed should be further assessed for its ability to support the proposed system.

Project Findings

SITE NAME	SHERIFF DEPARTMENT TRAINING ACADEMY – ROOFTOP

NEW ROOF INSTALLED 2023

9225 S 68th Street, Franklin, WI

SITE		PROPOSED SYSTEM	
PIN	8849994001	**Type**	Rooftop
We Energies Account No.	71785948300003	**Size**	• 99kW$_{DC}$ • 80kW$_{AC}$
We Energies Rate Tariff	Cg3		
Annual Electric Usage	528,906 kWh	**Estimated Cost**	$403,973
Roof Material	White TPO	**Estimated FOE Incentives**	$4,926
Roof Age	2023	**Annual Production**	125,246 kWh

IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	24%	**Energy Community**	No
Annual Tons of Carbon Offset	86 MTCO$_2$e	**Low Income Community**	No
Lifetime Utility Savings	$658,677	**Estimated IRA Impact**	25.5%
% County Carbon Offset	0.073%		
Estimated ROI	120%		
Payback Period (Years)	16.5		

SITE-SPECIFIC CONSIDERATIONS

- Structural capacity to support proposed system should be further assessed.
- Electrical capacity as observed should be further assessed for its ability to support the proposed system.
- 2023 ideal roof age.

Project Findings

SITE NAME	WILSON PARK – GROUND MOUNT-TRACKER

LOW INCOME COMMUNITY

4001 S 20th St, Milwaukee, WI

SITE		PROPOSED SYSTEM	
PIN	5779906114	**Type**	Ground Mount - Tracker
We Energies Account No.	71181845900182	**Size**	• 772kW$_{DC}$ • 600kW$_{AC}$
We Energies Rate Tariff	Cg3		
Annual Electric Usage	1,546,744 kWh	**Estimated Cost**	$2,430,918
Roof Material	N/A	**Estimated FOE Incentives**	$25,000
Roof Age	N/A	**Annual Production**	1,131,327 kWh

IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	73%	**Energy Community**	No
Annual Tons of Carbon Offset	506 MTCO$_2$e	**Low Income Community**	Yes
Lifetime Utility Savings	$3,709,246	**Estimated IRA Impact**	25.5%
% County Carbon Offset	0.432%		
Estimated ROI	105%		
Payback Period (Years)	17.6		

SITE-SPECIFIC CONSIDERATIONS

- Soil feasibility analyses such as soil borings should be performed to ensure feasibility.
- Geotechnical analysis should be performed during design.
- Electrical capacity as observed should be further assessed for its ability to support the proposed system.

Project Findings

SITE NAME	MILWAUKEE COUNTY ZOO ZOOFARI BUILDING – ROOFTOP

ENERGY COMMUNITY

9715 W Bluemound Rd, Milwaukee, WI

SITE	
PIN	4099988111
We Energies Account No.	7799100012
We Energies Rate Tariff	Cg3
Annual Electric Usage	377,393 kWh
Roof Material	White TPO
Roof Age	2025

PROPOSED SYSTEM	
Type	Rooftop
Size	• 171kW$_{DC}$ • 132kW$_{AC}$
Estimated Cost	$650,180
Estimated FOE Incentives	$8,555
Annual Production	215,165 kWh

IMPACT	
% Electric Usage Offset	57%
Annual Tons of Carbon Offset	101 MTCO$_2$e
Lifetime Utility Savings	$855,549
% County Carbon Offset	0.086%
Estimated ROI	101%
Payback Period (Years)	17.9

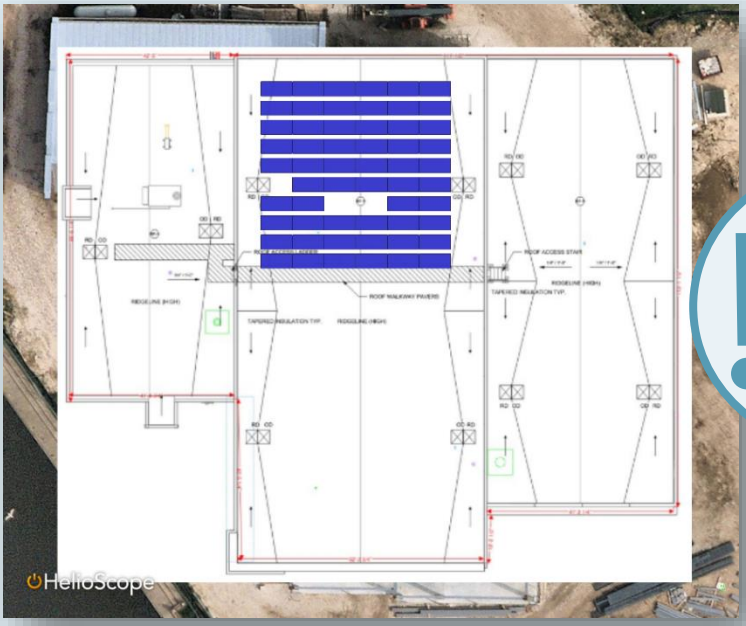
IRA IMPLICATIONS	
Energy Community	Yes
Low Income Community	No
Estimated IRA Impact	34%

SITE-SPECIFIC CONSIDERATIONS

- Structural capacity to support proposed system should be further assessed.
- Electrical capacity as observed should be further assessed for its ability to support the proposed system.
- Roof to be replaced in 2025, ideal timing for system installation.

Project Findings

SITE NAME	WASHINGTON PARK SERVICE YARD – ROOFTOP



NEW ROOF COMING 2025

LOW INCOME COMMUNITY

1859 N 40th Street, Milwaukee, WI

SITE		PROPOSED SYSTEM	
PIN	3479999112	**Type**	Rooftop
We Energies Account No.	71181845900032	**Size**	• 34kW$_{DC}$ • 33kW$_{AC}$
We Energies Rate Tariff	Cg1		
Annual Electric Usage	47,720 kWh	**Estimated Cost**	$142,928
Roof Material	Fully Adhered EPDM	**Estimated FOE Incentives**	$1,682
Roof Age	2025	**Annual Production**	42,118 kWh

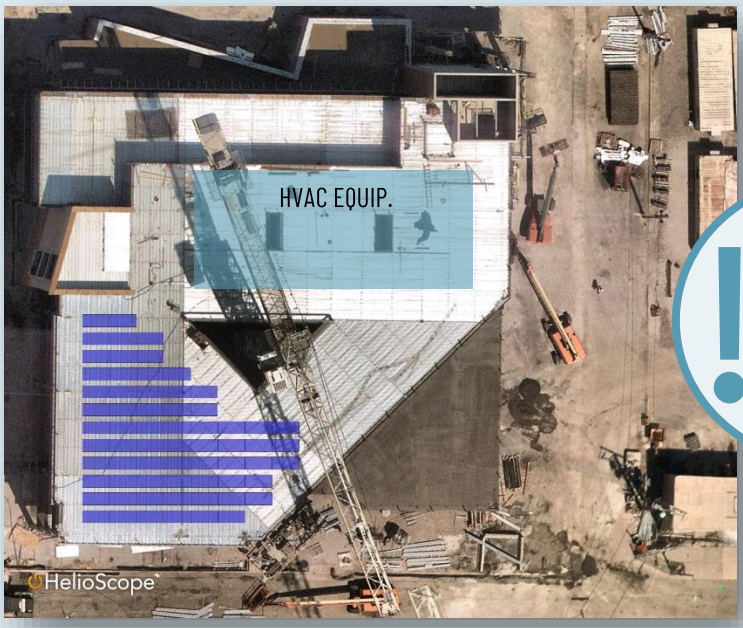
IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	88%	**Energy Community**	No
Annual Tons of Carbon Offset	16 MTCO$_2$e	**Low Income Community**	Yes
Lifetime Utility Savings	$185,966	**Estimated IRA Impact**	25.5%
% County Carbon Offset	0.013%		
Estimated ROI	75%		
Payback Period (Years)	26.2		

SITE-SPECIFIC CONSIDERATIONS

- Structural capacity to support proposed system should be further assessed.
- Electrical capacity as observed should be further assessed for its ability to support the proposed system.
- Roof to be replaced in 2025, ideal timing for system installation.

Project Findings

SITE NAME	MARCIA P. COGGS & DHHS BUILDING – ROOFTOP



NEW BUILD COMING 2025

LOW INCOME COMMUNITY

1230 W. Cherry S Milwaukee, WI

SITE		PROPOSED SYSTEM	
PIN	3633344000	**Type**	Rooftop
We Energies Account No.	TBD	**Size**	• 39kW$_{DC}$ • 33kW$_{AC}$
We Energies Rate Tariff	Cg3 (Estimate)		
Annual Electric Usage	758,737 kWh (Estimate)	**Estimated Cost**	$165,495
Roof Material	White TPO	**Estimated FOE Incentives**	$1,947
Roof Age	2024	**Annual Production**	48,889 kWh

IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	6%	**Energy Community**	No
Annual Tons of Carbon Offset	34 MTCO$_2$e	**Low Income Community**	Yes
Lifetime Utility Savings	$215,097	**Estimated IRA Impact**	25.5%
% County Carbon Offset	0.029%		
Estimated ROI	75%		
Payback Period (Years)	26.2		

SITE-SPECIFIC CONSIDERATIONS

- Structural capacity to support proposed system should be further assessed.
- As marked on the rendering above, there is a large rooftop unit (RTU) on the North side of the building's roof that significantly limits the sizing potential for a rooftop system.
- New build makes this site ideal for system installation.

Project Findings

SITE NAME	FACILITY MANAGEMENT SHOP AND OFFICE – ROOFTOP

LOW INCOME COMMUNITY

10930 W Lapham St West Allis, WI

SITE		PROPOSED SYSTEM	
PIN	4489996005	**Type**	Roof Mount
We Energies Account No.	70730965300043	**Size**	• 129kW$_{DC}$ • 100kW$_{AC}$
We Energies Rate Tariff	Cg3		
Annual Electric Usage	219,531 kWh	**Estimated Cost**	$503,919
Roof Material	Single Ply EPDM	**Estimated FOE Incentives**	$6,461
Roof Age	2013	**Annual Production**	163,540 kWh

IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	75%	**Energy Community**	No
Annual Tons of Carbon Offset	65 MTCO2e	**Low Income Community**	Yes
Lifetime Utility Savings	$641,990	**Estimated IRA Impact**	25.5%
% County Carbon Offset	0.056%		
Estimated ROI	72%		
Payback Period (Years)	20.2		

SITE-SPECIFIC CONSIDERATIONS

- Structural capacity to support proposed system should be further assessed.
- Electrical capacity as observed should be further assessed for its ability to support the proposed system.
- Roof age is currently 11 years, this site may not be feasible depending on further analysis of roofing condition since replacement scheduling is not likely for several years.

Project Findings

SITE NAME	NOYES PARK – ROOFTOP

8235 W Good Hope Road Milwaukee, WI

SITE		PROPOSED SYSTEM	
PIN	1189990110	**Type**	Rooftop
We Energies Account No.	71181845900076	**Size**	• 97kW$_{DC}$ • 80kW$_{AC}$
We Energies Rate Tariff	Cg3		
Annual Electric Usage	366,423 kWh	**Estimated Cost**	$396,716
Roof Material	EPDM	**Estimated FOE Incentives**	$4,838
Roof Age	2015	**Annual Production**	119,020 kWh

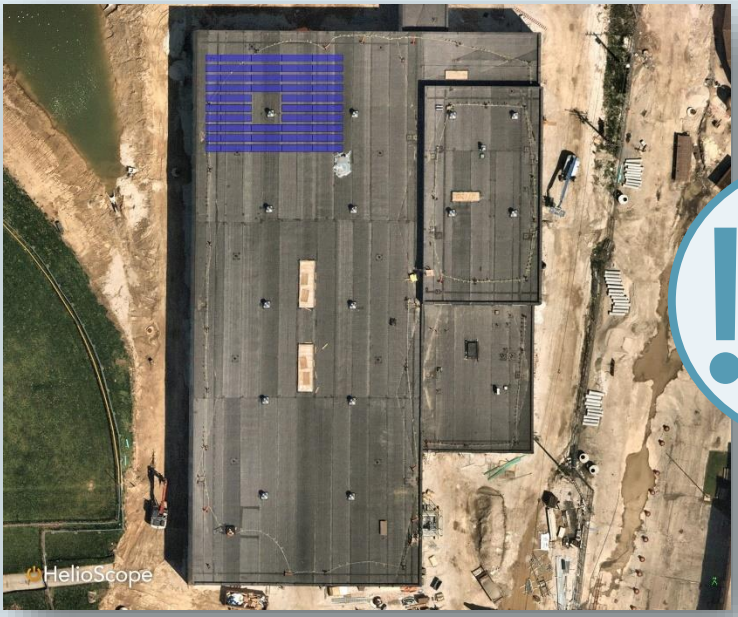
IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	33%	**Energy Community**	No
Annual Tons of Carbon Offset	72 MTCO$_2$e	**Low Income Community**	No
Lifetime Utility Savings	$497,385	**Estimated IRA Impact**	25.5%
% County Carbon Offset	0.062%		
Estimated ROI	71%		
Payback Period (Years)	26.2		

SITE-SPECIFIC CONSIDERATIONS

- Structural capacity to support proposed system should be further assessed.
- Electrical capacity as observed should be further assessed for its ability to support the proposed system.
- Roof age is currently 9 years, this site may not be feasible depending on further analysis of roofing condition since replacement scheduling is not likely for several years.

Project Findings

SITE NAME	NORTH SHOP – ROOFTOP



NEW ROOF INSTALLED 2024

LOW INCOME COMMUNITY

6270 N Hopkins St, Milwaukee, WI

SITE		PROPOSED SYSTEM	
PIN	1570021000	**Type**	Rooftop
We Energies Account No.	71018560400001	**Size**	• 49.6kW$_{DC}$ • 33kW$_{AC}$
We Energies Rate Tariff	Cg1		
Annual Electric Usage	65,384 kWh	**Estimated Cost**	$203,200
Roof Material	EPDM	**Estimated FOE Incentives**	$2,478
Roof Age	2024	**Annual Production**	60,934 kWh

IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	93%	**Energy Community**	No
Annual Tons of Carbon Offset	47 MCTCO$_2$e	**Low Income Community**	Yes
Lifetime Utility Savings	$251,488	**Estimated IRA Impact**	25.5%
% County Carbon Offset	0.038%		
Estimated ROI	67%		
Payback Period (Years)	20.6		

SITE-SPECIFIC CONSIDERATIONS

- Structural capacity to support proposed system should be further assessed.
- Electrical capacity as observed should be further assessed for its ability to support the proposed system.
- Roof replacement in 2024, ideal timing for system installation.
- Future load profile should be considered given additional roof capacity.

Project Findings

SITE NAME	MARCIA P. COGGS & DHHS BUILDING - CARPORT

LOW INCOME COMMUNITY

1230 W. Cherry S Milwaukee, WI

SITE		PROPOSED SYSTEM	
PIN	3633344000	**Type**	Carport
We Energies Account No.	TBD	**Size**	• 579kW$_{DC}$ • 480kW$_{AC}$
We Energies Rate Tariff	Cg3 (Estimate)		
Annual Electric Usage	758,737 kWh (Estimate)	**Estimated Cost**	$2,723,086
Roof Material	N/A	**Estimated FOE Incentives**	$25,000
Roof Age	N/A	**Annual Production**	733,354 kWh

IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	97%	**Low Income Community**	Yes
Annual Tons of Carbon Offset	256 MTCO$_2$e	**Energy Community**	No
Lifetime Utility Savings	$3,211,938	**Estimated IRA Impact**	25.5%
% County Carbon Offset	0.219%		
Estimated ROI	58%		
Payback Period (Years)	26.2		

SITE-SPECIFIC CONSIDERATIONS

- Electrical capacity as observed should be further assessed for its ability to support the proposed system due to limited drawing availability at the time of this study.
- The City of Milwaukee has certain height requirements for Accessory Use Solar. A plan review meeting should be scheduled early in the design process with the City to ensure compliance.
- Soil feasibility analyses such as soil borings should be performed to ensure feasibility.
- Peer design review recommended to maximize solar value, prior to agreeing to a contract for construction. This recommendation was factored into the statistics provided here.

Project Findings

SITE NAME	VEL R. PHILIPS JUVENILE JUSTICE CENTER – CARPORT

ENERGY COMMUNITY

10201 W Watertown Plank Rd, Wauwatosa, WI

SITE		PROPOSED SYSTEM	
PIN	3799999066	**Type**	Carport
We Energies Account No.	070730965300042	**Size**	• 779kW$_{DC}$ • 624kW$_{AC}$
We Energies Rate Tariff	Cg3		
Annual Electric Usage	1,779,766 kWh	**Estimated Cost**	$3,543,540
Roof Material	N/A	**Estimated FOE Incentives**	$25,000
Roof Age	N/A	**Annual Production**	938,700 kWh

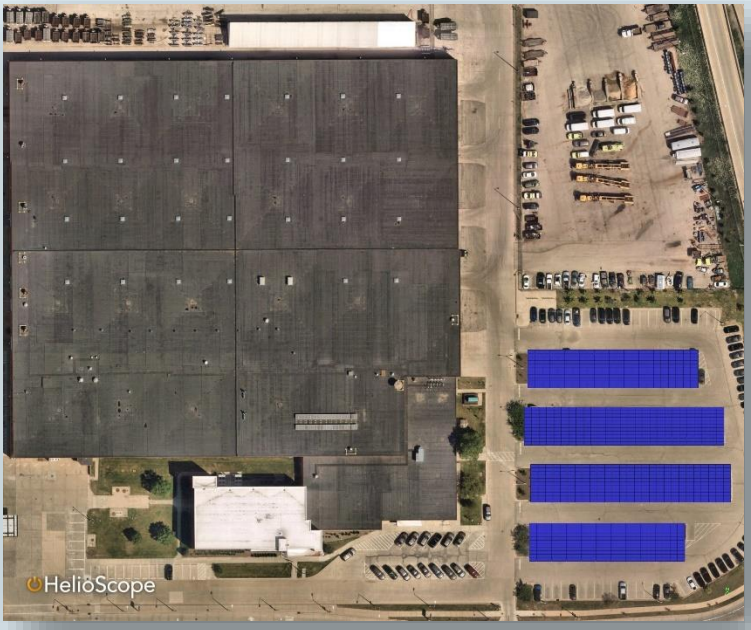
IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	53%	**Energy Community**	Yes
Annual Tons of Carbon Offset	453 MTCO$_2$e	**Low Income Community**	No
Lifetime Utility Savings	$3,705,260	**Estimated IRA Impact**	34%
% County Carbon Offset	0.386%		
Estimated ROI	58%		
Payback Period (Years)	21.5		

SITE-SPECIFIC CONSIDERATIONS

- Electrical capacity as observed should be further assessed for its ability to support the proposed system due to limited drawing availability at the time of this study.
- The City of Wauwatosa has certain height requirements for Accessory Use Solar. A plan review meeting should be scheduled early in the design process with the City to ensure compliance.
- Soil feasibility analyses such as soil borings should be performed to ensure feasibility.

Project Findings

SITE NAME	FLEET GARAGE AND MCDOT HEADQUARTERS - CARPORT



ENERGY COMMUNITY

10320 W Watertown Plank Rd, Wauwatosa, WI

SITE	
PIN	3749999022
We Energies Account No.	71366124600001
We Energies Rate Tariff	Cg3
Annual Electric Usage	1,102,673 kWh
Roof Material	N/A
Roof Age	N/A

PROPOSED SYSTEM	
Type	Carport
Size	• 636kW$_{DC}$ • 460kW$_{AC}$
Estimated Cost	$2,893,891
Estimated FOE Incentives	$25,000
Annual Production	796,399 kWh

IMPACT	
% Electric Usage Offset	72%
Annual Tons of Carbon Offset	306 $MTCO_2e$
Lifetime Utility Savings	$2,955,221
% County Carbon Offset	0.261%
Estimated ROI	54%
Payback Period (Years)	21.9

IRA IMPLICATIONS	
Energy Community	Yes
Low Income Community	No
Estimated IRA Impact	34%

SITE-SPECIFIC CONSIDERATIONS

- Electrical capacity as observed should be further assessed for its ability to support the proposed system due to limited drawing availability at the time of this study.
- The City of Wauwatosa has certain height requirements for Accessory Use Solar. A plan review meeting should be scheduled early in the design process with the City to ensure compliance.
- Soil feasibility analyses such as soil borings should be performed to ensure feasibility.

Project Findings

FURTHER CONSIDERATIONS

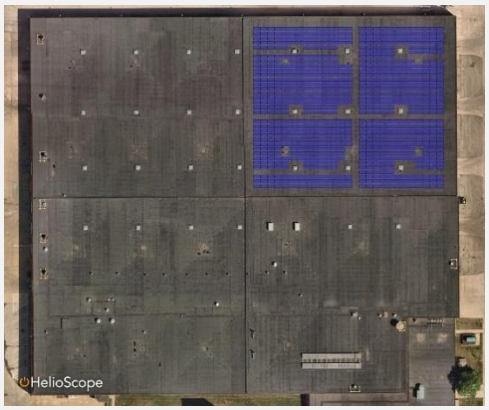
The following depicts a portion of the "Solar Energy Feasibility Assessment for the Milwaukee County Central Fleet Maintenance Building" issued in April 2024 by the Avantii Design Group (ADG):

In conclusion, per the load analysis of the existing structure, the building does not have the capacity to support the required loading. Therefore, reinforcements are required. The analysis was performed by first comparing the above loading to joist load tables from Bethlehem Steel. This load analysis showed the additional weight of the solar panels and ballasts would overload the joists. The load tables indicate the total safe load for these joists is 50.6 for joist type 1, and 41 psf for joist type 2. Further work was done with a 2D frame analysis that was used in conjunction with a Steel Joist Institute Design Tool, focused on joist reinforcement. Both the ballast and non-ballast option would require reinforcement.

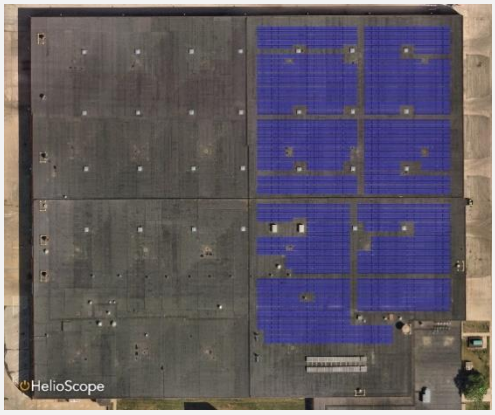
Per this structural study, McKinstry sought validation of options to reduce existing roof load and evaluate if varying design factors could enable rooftop solar PV at this location.

ADDITIONAL ROOFTOP CONSIDERATIONS *(Pricing includes structural and electrical upgrades = $650,000)*

469KW$_{DC}$



849KW$_{DC}$



1,349KW$_{DC}$

1,877KW$_{DC}$

Project Findings

FLEET GARAGE ROOFTOP SYSTEMS										
System Size		Current Consumption	Production	Offset	Export	System Cost	Value of Solar	Annual Savings	IRA	FOE
kW_{DC}	kW_{AC}	kWh	kWh	%	%	$	$/kWh	$	$	$
469	360	1,102,673	590,235	54%	33%	$2,260,800	0.089	$52,777	$904,320	$23,455
850	640	1,102,673	1,068,400	97%	54%	$3,823,200	0.072	$86,499	$1,529,280	$25,000
1,349	1,000	1,102,673	1,696,950	154%	70%	$5,664,708	0.071	$129,739	$2,265,883	$25,000
1,877	1,440	1,102,673	2,358,616	214%	77%	$7,507,160	0.022	$51,315	$3,002,864	$25,000

Given the available rooftop real estate available at the Fleet Garage, as well as potential future investment in further electrifying the County's fleet, thus increasing demand at this location, the County Project Team asked for multiple potential system models for this site. The table above demonstrates four (4) potential rooftop systems of varying sizes from 469kW_{DC} to 1,877kW_{DC}.

This table highlights the critical nature of right-sizing solar PV systems to balance the benefits of decarbonization with economic conditions. The 1,877kW_{DC} and 1,440kWac systems that would cover the entirety of the Fleet Garage roof would put this system into the category of >1MW_{AC}, which, in We Energies solar guidelines, eliminates the ability to monetize export electricity to the grid, rendering this project financially unfeasible.

The remaining three (3) proposed systems have diminishing Value of Solar (VOS) as system size (kW) increases. This means consideration must be given by the appropriate County staff to the degree and pace at which the County's transportation infrastructure may be electrified. Only an increase in demand at the Fleet Garage could clarify exactly what size system is optimal for this site. If no changes to demand were made, meaning no electrification were pursued, the smallest rooftop system would make the most sense of all rooftop options for implementation. However, if the County intends to install several electric vehicle charging stations, EV bus chargers, or otherwise increase the electrical load on-site, the proposed system calculations in the above table. This would need to be revisited to assess how changes in the site's utility load profile impacts demand and thereby any proposed solar PV systems.

Please note, all proposed systems include $650,000 in necessary structural and electrical upgrades outlined in the ADG study.

Project Findings

SITE NAME	SPORTS COMPLEX – ROOFTOP

6000 W Ryan Rd Franklin, WI

SITE		PROPOSED SYSTEM	
PIN	8829987001	**Type**	Rooftop
We Energies Account No.	71689410000001	**Size**	• 273kW$_{DC}$ • 200kW$_{AC}$
We Energies Rate Tariff	Cg3		
Annual Electric Usage	346,492 kWh	**Estimated Cost**	$1,022,175
Roof Material	White TPO	**Estimated FOE Incentives**	$13,629
Roof Age	Replacement in 2026/2028	**Annual Production**	340,713 kWh

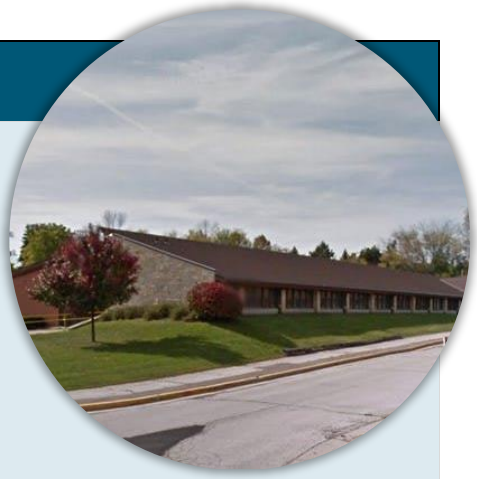
IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	98%	**Energy Community**	No
Annual Tons of Carbon Offset	107 MTCO$_2$e	**Low Income Community**	No
Lifetime Utility Savings	$1,122,950	**Estimated IRA Impact**	25.5%
% County Carbon Offset	0.091%		
Estimated ROI	50%		
Payback Period (Years)	26.2		

SITE-SPECIFIC CONSIDERATIONS

- Structural capacity to support proposed system should be further assessed.
- Electrical capacity as observed should be further assessed for its ability to support the proposed system.
- Roof replacement in 2026-2028, ideal timing for system installation.

Project Findings

SITE NAME	WILSON PARK SENIOR CENTER - CARPORT



LOW INCOME COMMUNITY

2601 W Howard Ave, Milwaukee, WI

SITE		PROPOSED SYSTEM	
PIN	5779906114	**Type**	Carport
We Energies Account No.	70730965300045	**Size**	• 241kW$_{DC}$ • 200kW$_{AC}$
We Energies Rate Tariff	Cg3		
Annual Electric Usage	360,771 kWh	**Estimated Cost**	$1,263,780
Roof Material	N/A	**Estimated FOE Incentives**	$12,036
Roof Age	N/A	**Annual Production**	307,539 kWh

IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	85%	**Energy Community**	No
Annual Tons of Carbon Offset	123 MTCO$_2$e	**Low Income Community**	Yes
Lifetime Utility Savings	$1,373,284	**Estimated IRA Impact**	25.5%
% County Carbon Offset	0.105%		
Estimated ROI	46%		
Payback Period (Years)	22.9		

SITE-SPECIFIC CONSIDERATIONS

- Electrical capacity as observed should be further assessed for its ability to support the proposed system due to limited drawing availability at the time of this study.
- The City of Milwaukee has certain height requirements for Accessory Use Solar. A plan review meeting should be scheduled early in the design process with the City to ensure compliance.
- Soil feasibility analyses such as soil borings should be performed to ensure feasibility.

Project Findings

SITE NAME	COMMUNITY REINTEGRATION CENTER - CARPORT

8885 S 68th St, Franklin, WI

SITE		PROPOSED SYSTEM	
PIN	8500003000	**Type**	Carport
We Energies Account No.	71233712000014	**Size**	• 1,474kW$_{DC}$ • 1,000kW$_{AC}$
We Energies Rate Tariff	Cp1		
Annual Electric Usage	6,304,393 kWh	**Estimated Cost**	$6,634,845
Roof Material	N/A	**Estimated FOE Incentives**	$25,000
Roof Age	N/A	**Annual Production**	1,775,094 kWh

IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	28%	**Energy Community**	No
Annual Tons of Carbon Offset	1,241 MTCO$_2$e	**Low Income Community**	No
Lifetime Utility Savings	$7,147,274	**Estimated IRA Impact**	25.5%
% County Carbon Offset	1.016%		
Estimated ROI	45%		
Payback Period (Years)	22.9		

SITE-SPECIFIC CONSIDERATIONS

- Electrical capacity as observed should be further assessed for its ability to support the proposed system.
- The City of Franklin's guidelines for solar are less specific than other AHJs, but most have certain height requirements for Accessory Use Solar. A plan review meeting should be scheduled early in the design process with the City to ensure compliance.
- The method of interconnection from the solar energy system to the building needs further exploration.
- This system is one of the few that this study determined could benefit from pairing with a battery energy storage system.
- Soil feasibility analyses such as soil borings should be performed to ensure feasibility.

Project Findings

SITE NAME	SHERIFF DEPARTMENT TRAINING ACADEMY – CARPORT

9225 S 68th St, Franklin, WI

SITE		PROPOSED SYSTEM	
PIN	8849994001	**Type**	Carport
We Energies Account No.	71785948300003	**Size**	• 315kW$_{DC}$ • 240kW$_{AC}$
We Energies Rate Tariff	Cg3		
Annual Electric Usage	528,906 kWh	**Estimated Cost**	$1,635,244
Roof Material	N/A	**Estimated FOE Incentives**	$15,724
Roof Age	N/A	**Annual Production**	378,034 kWh

IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	72%	**Energy Community**	No
Annual Tons of Carbon Offset	172 $MTCO_2e$	**Low Income Community**	No
Lifetime Utility Savings	$1,690,687	**Estimated IRA Impact**	25.5%
% County Carbon Offset	0.147%		
Estimated ROI	39%		
Payback Period (Years)	27.2		

SITE-SPECIFIC CONSIDERATIONS

- Electrical capacity as observed should be further assessed for its ability to support the proposed system.
- The City of Franklin's guidelines for solar are less specific than other AHJs, but most have certain height requirements for Accessory Use Solar. A plan review meeting should be scheduled early in the design process with the City to ensure compliance.
- Soil feasibility analyses such as soil borings should be performed to ensure feasibility.

Project Findings

SITE NAME	MITCHELL PARK - CARPORT

LOW INCOME COMMUNITY

524 S Layton Blvd, Milwaukee, WI

SITE		PROPOSED SYSTEM	
PIN	4259997000	**Type**	Carport
We Energies Account No.	71149619200001	**Size**	• 363kW$_{DC}$ • 264kW$_{AC}$
We Energies Rate Tariff	Cg3		
Annual Electric Usage	458,127 kWh	**Estimated Cost**	$1,908,060
Roof Material	N/A	**Estimated FOE Incentives**	$18,172
Roof Age	N/A	**Annual Production**	455,815 kWh

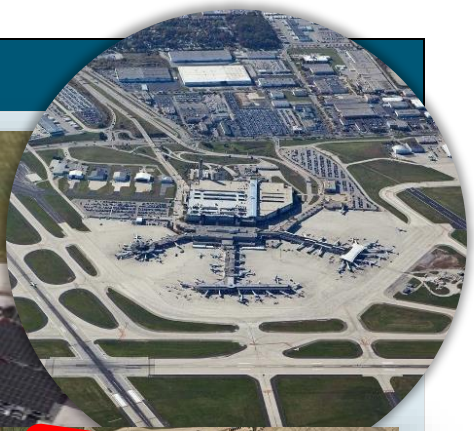
IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	99%	**Energy Community**	No
Annual Tons of Carbon Offset	153 MTCO$_2$e	**Low Income Community**	Yes
Lifetime Utility Savings	$1,918,174	**Estimated IRA Impact**	25.5%
% County Carbon Offset	0.130%		
Estimated ROI	35%		
Payback Period (Years)	27.2		

SITE-SPECIFIC CONSIDERATIONS

- Electrical capacity as observed should be further assessed for its ability to support the proposed system.
- The City of Milwaukee has certain height requirements for Accessory Use Solar. A plan review meeting should be scheduled early in the design process with the City to ensure compliance.
- The method of interconnection from the solar energy system to the building needs further exploration.
- Soil feasibility analyses such as soil borings should be performed to ensure feasibility.

Project Findings

SITE NAME	GENERAL MITCHELL AIRPORT – CARPORT



5300 S Howell Ave, Milwaukee, WI

SITE		PROPOSED SYSTEM	
PIN	6409999120	**Type**	Carport
We Energies Account No.	8761000022	**Size**	• 2,047kW$_{DC}$ • 1,600kW$_{AC}$
We Energy Rate Tariff	Cp1		
Annual Electric Usage	10,529,561 kWh	**Estimated Cost**	$9,005,524
Roof Material	N/A	**Estimated FOE Incentives**	$25,000
Roof Age	N/A	**Annual Production**	2,586,711 kWh

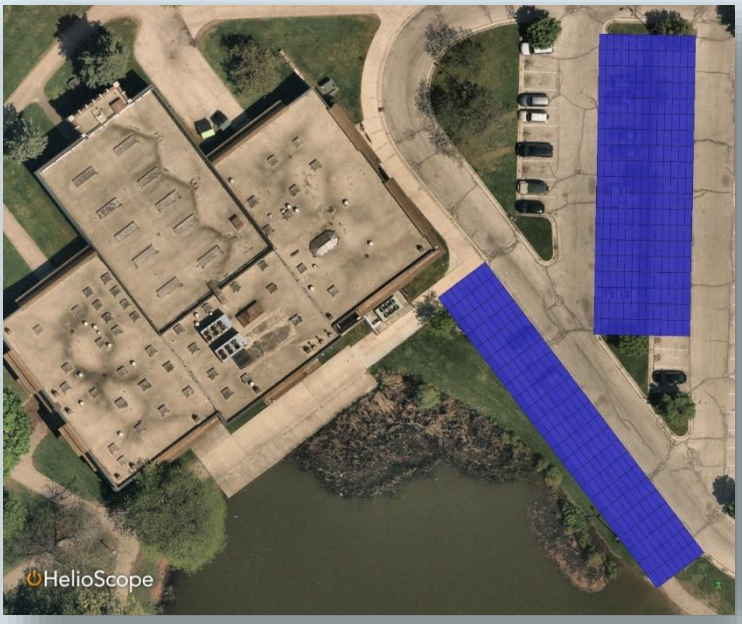
IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	25%	**Energy Community**	No
Annual Tons of Carbon Offset	1,627 MTCO$_2$e	**Low Income Community**	No
Lifetime Utility Savings	$8,297,202	**Estimated IRA Impact**	25.5%
% County Carbon Offset	1.388%		
Estimated ROI	24%		
Payback Period (Years)	25.7		

SITE-SPECIFIC CONSIDERATIONS

- The Federal Aviation Administration (FAA) has requirements for solar energy systems installed on/near airport properties that will need to be adhered to in any future design processes.
- The City of Milwaukee has certain height requirements for Accessory Use Solar. A plan review meeting should be scheduled early in the design process with the City to ensure compliance.
- The method of interconnection from the solar energy system to the building needs further exploration.
- Given the critical nature of this site's function, possible microgrid applications using battery energy storage should be considered during design. This system is one of the few that this study determined could benefit from pairing with a battery energy system.
- Soil feasibility analyses such as soil borings should be performed to ensure feasibility.

Project Findings

SITE NAME	KOSCIUSZKO COMMUNITY CENTER - CARPORT



LOW INCOME COMMUNITY

2201 S 7th St Milwaukee, WI

SITE		PROPOSED SYSTEM	
PIN	4689999000	**Type**	Carport
We Energies Account No.	71181845900062	**Size**	• 254kW$_{DC}$ • 200kW$_{AC}$
We Energies Rate Tariff	Cg3		
Annual Electric Usage	456,696 kWh	**Estimated Cost**	$1,335,023
Roof Material	N/A	**Estimated FOE Incentives**	$12,715
Roof Age	N/A	**Annual Production**	310,820 kWh

IMPACT		IRA IMPLICATIONS	
% Electric Usage Offset	68%	**Energy Community**	No
Annual Tons of Carbon Offset	148 $MTCO_2e$	**Low Income Community**	Yes
Lifetime Utility Savings	$1,143,169	**Estimated IRA Impact**	25.5%
% County Carbon Offset	0.187%		
Estimated ROI	15%		
Payback Period (Years)	27.2		

SITE-SPECIFIC CONSIDERATIONS

- Electrical capacity as observed should be further assessed for its ability to support the proposed system.
- The City of Milwaukee has certain height requirements for Accessory Use Solar. A plan review meeting should be scheduled early in the design process with the City to ensure compliance.
- Soil feasibility analyses such as soil borings should be performed to ensure feasibility.

Project Findings

SECONDARY RECOMMENDATIONS

SITE NAME	SYSTEM TYPE	SYSTEM SIZE (KWDC)	PRODUCTION (KWH)	OFFSET (%)	CONSIDERATIONS
Fond Du Lac Complex	Carport	545	693,064	71%	• More costly compared to a rooftop system. • May have a long route for interconnection. • Lower value of solar compared to other systems.
Milwaukee Mitchell International Airport	Parking Garage	1,523	1,829,192	18%	• Complex design and install • Cost Prohibitive compared to carport and ground mount option. • When added to carport and ground mount, significantly more exported energy from the system that would not receive any compensation.
KK Transit Complex	Rooftop	671	839,834	80%	• Very little amount of structural capacity available. • New sprinkler system and RTUs may take up all available capacity • Further engineering is needed to determine if a solar array is feasible for this site.
King Community Center	Carport	190	241,006	56%	• Odd spacing for carport; may be too large • May need electrical infrastructure upgrade. • Costly system
King Community Center	Rooftop	76	93,373	22%	• Small rooftop system • Structural analysis needed • Older rooftop; however, could be replaced in the near future.
Milwaukee County Zoo	Rooftop	146	184,741	2%	• Challenging electrical infrastructure • Structural analysis needed • Small rooftop system
Milwaukee County Zoo	Carport	1,551	1,857,234	20%	• Challenging electrical infrastructure – may need to be upgraded • Costly system

Sites below were analyzed after passing the matrix but then deemed not feasible after further analysis. Sites in table labeled *Unfeasible Sites* are not viable based on initial matrix screening.

Project Findings

UNFEASIBLE SITES

SITE NAME	INSUFFICIENT LOAD <200,000 kWh/YEAR	PROXIMITY TO LOAD NOT FEASIBLE	SYSTEM COMPLEXITY	REAL ESTATE UNAVAILABLE FOR SOLAR	LOW CARBON OFFSET POTENTIAL (SMALL SYSTEM SIZE)	ROOF AGE
Botanical Gardens Visitors and Education		x	x			x
Brown Deer Park	x				x	x
Clinton Rose Senior Center					x	
Courthouse Complex				x		
Grant Park	x				x	
Greenfield Outdoor Pool	x				x	
Lincoln Park	x				x	
Marcus Center for Performing Arts				x		x
Mary Ryan Boys & Girls Club			x	x	x	x
McKinley Marina	x		x		x	
Milwaukee Public Museum					x	x
MKE County Parks Admin Building					x	
Park Maintenance	x				x	x
Pulaski Park-Milwaukee					x	
Red Arrow Park				x	x	
South Shore Park	x		x		x	
Timmerman Field	x				x	
Washington Park Senior Center					x	x

ADDITIONAL CLARIFICATIONS FOR UNFEASIBLE SITES

COURTHOUSE COMPLEX

This complex is the County's largest consumer of energy, however, there is very limited real estate available for either a rooftop, carport or ground mount solar PV systems to help offset this consumption. Further reducing any potential for rooftop solar, the County plans to decommission the Safety Building.

Being such a large energy load with one single We Energies account, this site presents a good opportunity to partner with We Energies through the Renewable Pathways program, outlined above. Additionally, the County currently has a request for proposal (RFP) open for energy efficiency upgrades for the Courthouse Complex at the time of this report's issuance. This RFP, along with the Renewable Pathways Program through We Energies, is the best option for reducing the carbon emissions for this complex, as on-site solar is unfeasible.

Project Findings

MITCHELL PARK

Two green spaces were assessed during the site visit. Both sites have significant grade that would not allow for a solar array. Additionally, both arrays have long distances to the interconnection point that would be too costly for the system.

SPORTS COMPLEX

Green space to the north of the building was assessed while on site, however, is too far from the building and interconnection point.

KOSCIUSKO COMMUNITY CENTER

A rooftop system is favorable at most sites due to the economics of the system, however, the rooftop has too many obstructions and pieces of equipment that creates a choppy and small solar array.

NOYES PARK

A ground mount at Noyes Park is not feasible due to usage of the land. The greenspace identified is part of a driving range and a golf course, which is not favorable for a solar array due to the potential for golf balls to hit and damage the solar PV panels. The green space where the old chipping green is located would be too small for a ground mount system as well, once setbacks and a fence are added.

FOND DU LAC

The rooftop has a large open area that would hold a significant amount of solar to offset the building consumption, however, after further structural analysis, there is no additional capacity to add solar, either with a ballasted system or with mechanical attachments. Even if structural supports were to be added, which would significantly increase the cost of the system, mechanical attachments would likely be needed, which compromises the roof membrane and could potentially cause leaks in the roof.

SECTION 7

IRA Explained

Conclusion

ABOUT

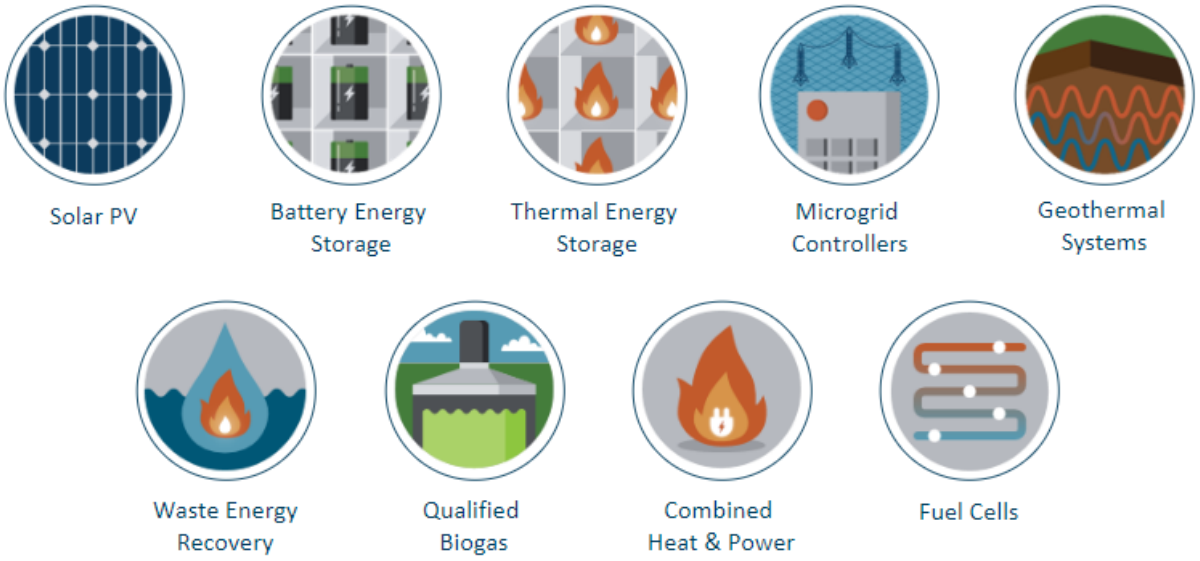
The Inflation Reduction Act (IRA) presents an unprecedented opportunity to innovate waste and climate harm out of the built environment. It invests $386 billion over 10 years in clean energy spending and tax incentives, making it the largest investment ever made by the federal government to slow climate change and reduce our reliance on the fossil fuels responsible for the climate crisis. New under the Inflation Reduction Act (IRA), tax-exempt entities can now take advantage of specific tax credits within the IRA through Direct Pay (aka Elective Pay). A tax credit is a dollar-for-dollar reduction to your tax liability.

Except for the airport and CRC carports, all proposed projects are less than 1MWac. ↓

For the Investment Tax Credit for Energy Property (ITC), the legislation offers a baseline 6% credit, with a 5X multiplier if projects comply with labor requirements or are under $1MW_{AC}$ in generation to increase the credit to 30%. Apart from the Milwaukee Mitchell International Airport and the Community Reintegration Center carports, all proposed projects are less than $1MW_{AC}$. There are additional opportunities for bonus credits when factoring in domestic content, energy community and low-income bonus credits.

The Investment Tax Credit for Energy Property program as we currently are referencing is described by section 48 of the tax code, this code section is applicable through December 31, 2024. Beginning January 1, 2025, the Clean Electricity Investment Tax Credit (section 48e of tax code) becomes effective and provides a technology-neutral tax credit for investment in facilities that generate clean electricity and replaced the previous ITC for facilities generating electricity from renewable sources. Phase out starts the later of (a) 2032 or (b) when U.S. greenhouse gas emissions from electricity are 25% of 2022 emissions or lower. As is currently understood, the tech-neutral ITC will remain the same in reference to credit, bonuses, and requirements with the exception that some technologies will not carry forward into 2025. As of the latest proposed guidance solar, energy storage, geothermal systems, and certain types of waste energy recovery will continue to be eligible through 2032.

ITC ELIGIBLE ENERGY PROPERTY TECHNOLOGIES INCLUDED UNTIL 2025



IRA Explained

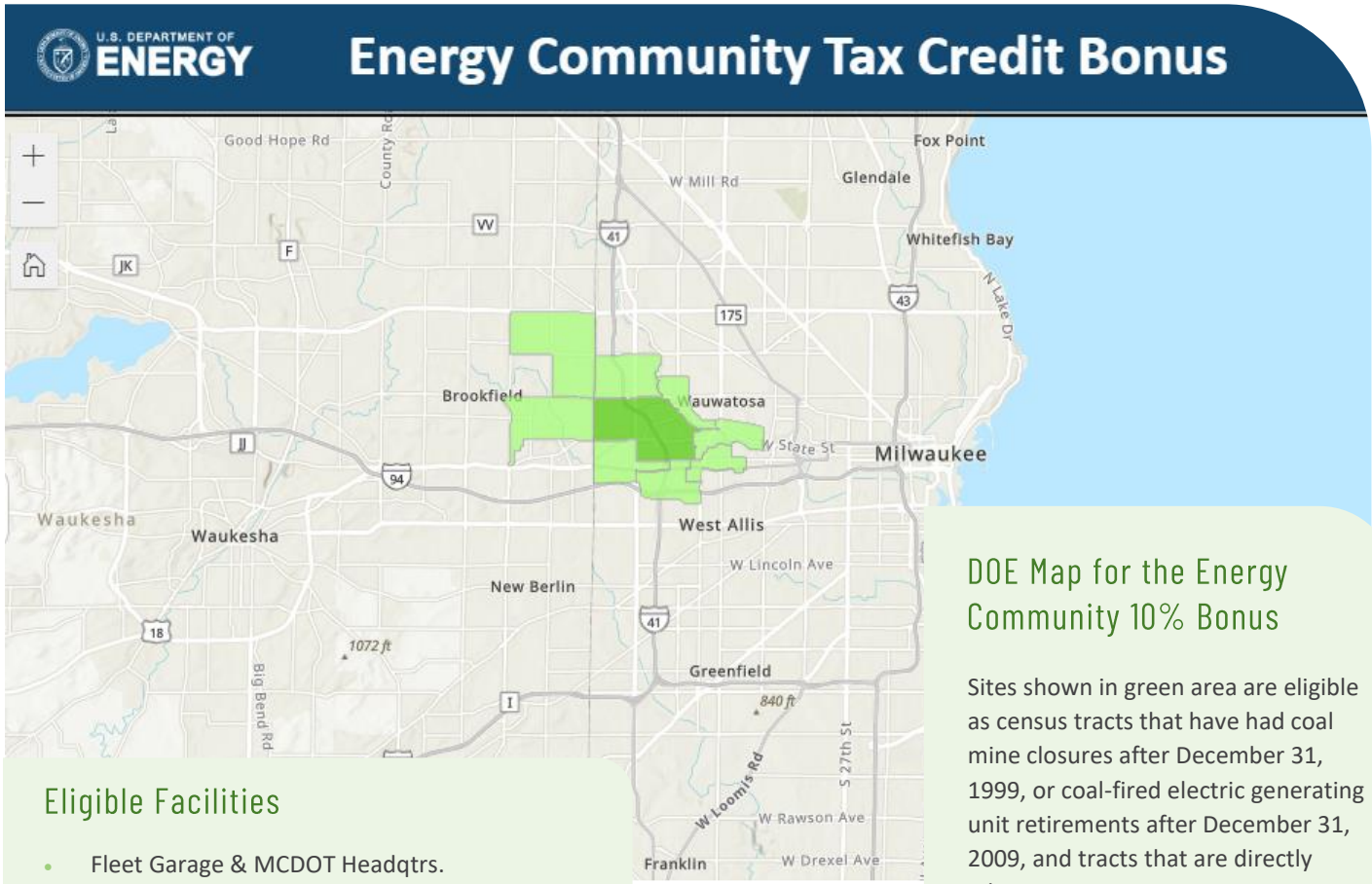
RELATIONSHIP TO OTHER FEDERAL FUNDS

Not to exceed 100% of funds, the sweet spot could be 70% financed with Federal grant, cash for the 30% and then the ITC could potentially reimburse the 30% back.

The Investment Tax Credit (ITC) for energy property, such as solar energy systems, is designed to reduce the federal income tax liability for a percentage of the cost of the system installed during the tax year. The credit amount cannot exceed 100% of the tax liability, meaning it can reduce your tax bill to zero but not beyond that.

2-10% ENERGY COMMUNITY BONUS

This bonus can increase the tax credit amount by 10% with no application required. Each solar PV system featured in the individual site evaluations in the previous section includes in its summary table a “yes” or “no” identifier for whether or not that system fits the criteria for the 10% Energy Community Bonus.



Eligible Facilities

- Fleet Garage & MCDOT Headqtrs.
- Vel R. Phillips Youth and Family Justice Center
- Milwaukee County Zoo - Zoofari Building

DOE Map for the Energy Community 10% Bonus

Sites shown in green area are eligible as census tracts that have had coal mine closures after December 31, 1999, or coal-fired electric generating unit retirements after December 31, 2009, and tracts that are directly adjoining.

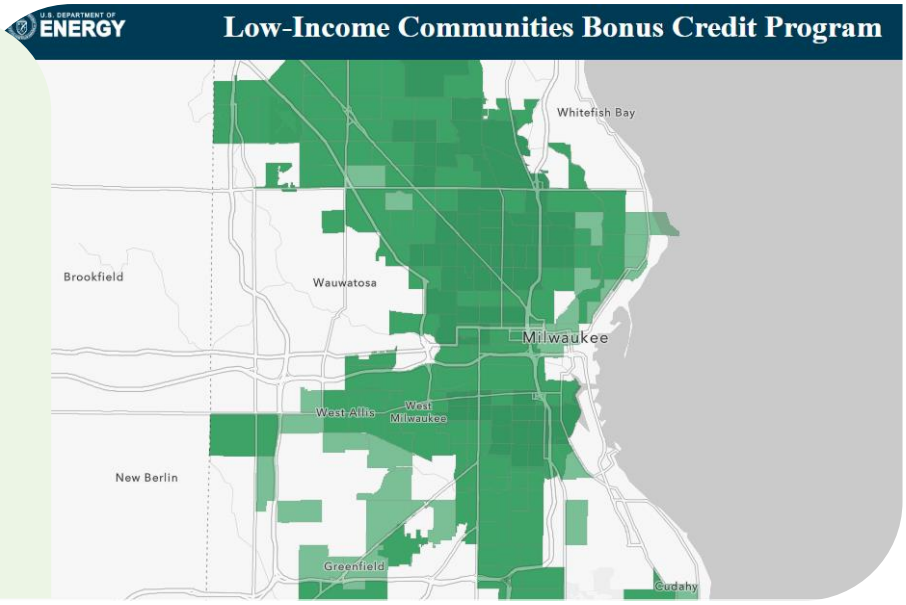
IRA Explained

10-20% LOW-INCOME BONUS

This competitive bonus can increase the tax credit amount by 10-20% if awarded the bonus allocation. Specific Megawatt (MW) allocations set per year, per category of type of project with application windows opening annually. Bonus must be applied for and awarded prior to project completion. Each solar PV system featured in the *Site Evaluation* section above includes in its summary table a "yes" or "no" identifier for whether or not that system fits the criteria for the 10% Low-income Community Bonus.

Eligible Facilities

- Fond Du Lac Complex
- Hillside Complex - Maintenance Bldg & Admin Bldg
- KK Transit Complex
- North Shop
- Wilson Park Senior Center
- New Coggs, DHHS Building
- Washington Park Service Yard
- Facility Management Shop and Office
- Kosciuszko Community Center
- Mitchell Park (incl Domes & Greenhouse)



CATEGORY	MAX BONUS	MW ALLOCATION FOR 2024 *THIS APPLICATION WINDOW IS CLOSED
1 – Low-income Community (eligibility determined via map)	10%	800
2- Located on Tribal Land	10%	200
3- Qualified Low-Income Residential Project	20%	225
4- Qualified Low-Income Economic Benefit Project	20%	900

The low-income bonus gives priority to projects that meet one of the following Additional Selection Criteria (ASC), additional priority may be given to projects that meet both:

- Ownership Criteria - A qualified solar or wind facility will meet the Ownership Criteria if it is owned by a Tribal enterprise, an Alaska Native Corporation, a renewable energy cooperative, a qualified renewable energy company meeting certain characteristics, or a qualified tax-exempt entity. The county qualifies as tax-exempt entity and should be eligible for prioritization of the bonus.
- Geographic Criteria - To meet the Geographic Criteria, a facility would need to be located in a Persistent Poverty County or in a census tract that is designated in the Climate Economic Justice Screening Tool as disadvantaged based on whether the tract is either (a) greater than or equal to the 90th percentile for energy burden and is greater than or equal to the 65th percentile for low income, or (b) greater than or equal to the 90th percentile for $PM_{2.5}$ exposure and is greater than or equal to the 65th percentile for

low income. The geographic criteria eligibility is indicated on the map tool with purple shading, we have analyzed which sites may be eligible.

5X MULTIPLIER LABOR REQUIREMENTS

To achieve the maximum credit projects will need to comply with the prevailing wage and apprenticeship requirements to multiply credit 5X, if project nameplate capacity is under 1MW$_{AC}$ the can be exempt from the labor requirements and still receive 5X multiplier. Here is an excerpt from the code section:
Increased credit amounts are available under §§ 30C, 45, 45Q, 45V, 45Y, 45Z, 48, 48C, and 48E, and an increased deduction is available under § 179D, for taxpayers satisfying certain prevailing wage and apprenticeship requirements.

Prevailing Wage Requirements. Section 45(b)(7)(A) provides that to meet the prevailing wage requirements with respect to any qualified facility, a taxpayer must ensure that any laborers and mechanics employed by the taxpayer or any contractor or subcontractor in: (i) the construction of such facility, and (ii) the alteration or repair of such facility (with respect to any taxable year, for any portion of such taxable year that is within the 10-year period beginning on the date the qualified facility is originally placed in service), are paid wages at rates not less than the prevailing rates for construction, alteration, or repair of a similar character in the locality in which such facility is located as most recently determined by the Secretary of Labor, in accordance with subchapter IV of chapter 31 of title 40, United States Code (Prevailing Wage Rate Requirements). Section 45(b)(7)(B) provides correction and penalty mechanisms for a taxpayer's failure to satisfy the requirements under § 45(b)(7)(A).

Apprenticeship Requirements. Section 45(b)(8)(A)(i) provides that to meet the apprenticeship requirements taxpayers must ensure that, with respect to the construction of any qualified facility, not less than the applicable percentage of the total labor hours of the construction, alteration, or repair work (including such work performed by any contractor or subcontractor) with respect to such facility is, subject to § 45(b)(8)(B), performed by qualified apprentices (Apprenticeship Labor Hour Requirements). Under § 45(b)(8)(A)(ii), for purposes of § 45(b)(8)(A)(i), the applicable percentage is: (i) in the case of a qualified facility the construction of which begins before January 1, 2023, 10 percent, (ii) in the case of a qualified facility the construction of which begins after December 31, 2022, and before January 1, 2024, 12.5 percent, and (iii) in the case of a qualified facility the construction of which begins after December 31, 2023, 15 percent.

Section 45(b)(8)(B) provides that the requirement under § 45(b)(8)(A)(i) is subject to any applicable requirements for apprentice-to-journey worker ratios of the Department of Labor or the applicable State Apprenticeship Agency (Apprenticeship Ratio Requirements). Section 45(b)(8)(C) provides that each taxpayer, contractor, or subcontractor who employs 4 or more individuals to perform construction, alteration, or repair work with respect to the construction of a qualified facility must employ 1 or more qualified apprentices to perform such work (Apprenticeship Participation Requirements).

2-10% DOMESTIC CONTENT BONUS

Domestic Content is generally defined as steel, iron or manufactured products thar are manufactured or produced in the United States, this is specific to the IRA and is different from Build America, Buy America Act (BABA). Domestic Content compliance is made of two parts; 100% of iron or steel components (or components that are structural by nature) must be manufactured or produced in the United States, manufactured products

which are components of a qualified facility upon completion of construction shall be deemed to have been produced in the United States if not less than the adjusted percentage of the total costs of all such manufactured products of such facility are attributable to manufactured products (including components) which are mined, produced, or manufactured in the United States" (Adjusted Percentage Rule).

Domestic content is an optional 2-10% (see Labor Requirements for explanation of 5X multiplier) bonus credit but given the counties tax-exempt status there may be a requirement to comply. For projects over 1Mwac that are tax-exempt (pursuing direct pay) there is the potential risk of a credit haircut if domestic content is not met or the exemptions are not proven. The haircut is a 10% reduction to overall credit for projects that began in 2024, 15% reduction for projects in 2025, and a 100% reduction for projects in 2026 and after that don't comply when required. See Appendix for reference flow charts for domestic content.

Currently many ITC technologies do not have equipment that is readily available to be able to comply with this bonus. There are safe harbors to waive the Domestic Content requirements, these include; if compliance increases project cost by 25%, or equipment is not readily available that meets the requirements.

TAX-EXEMPT BOND REDUCTION

Under the IRA Direct Pay Program, projects using tax-exempt bonds to finance projects are subject to a 15% reduction of the overall tax credit. During conversations with Milwaukee County staff, it was determined that future projects implemented as a result of this, or other, feasibility and/or design efforts will likely be funded using general obligation (GO) bonds. To be conservative, investment tax credit (ITC) estimations included herein assume 30% ITC with a 15% tax-exempt funding reduction, resulting in an effective base credit estimate of 25.5% [(30%*(100-15%) = 25.5%].

HOW IT WORKS

Eligible projects can claim the Direct Pay tax credit once the project has been placed in service (in a state of readiness to perform its designed function). A County representative (McKinstry recommends hiring a licensed tax advisor) can follow the steps set by the IRS.

EV CHARGING

Under the IRA is the Alternative Fuel Vehicle Refueling Property Credit (30C) that provides a tax credit for EV charging and other alternative fuels in low-income and rural areas. This program is available for tax-exempt entities to take advantage of through direct pay. The EV tax credit has a 6% baseline credit or 30% if the project meets labor requirements, up to a maximum of $100,000 per charger.

OUR TEAM

Driven by the Inflation Reduction Act (IRA), McKinstry assembled a Funding Strategy Team. This team is responsible for staying abreast across all federal funding guidance, compliance, and any new funding announcements at the federal, state, and local level. Maximizing this knowledge, the funding team educates our various McKinstry lines of business on programs that may be relevant to specific projects. This team provides hands on support to clients and community organizations helping to best understand the variety of federal tax incentives, grants, and other programs that can be utilized. McKinstry and the team retain expert advice from

multiple industry tax consultants to understand and navigate the complexities of the IRA legislation. We are on the forefront to ensure our clients understand and maximize their potential funding benefits.

BID DOCUMENTS

McKinstry has experience working with IRA funds and has processes in place to pass through IRA responsibilities to our subcontractors. As an example, we have subcontract language to pass the Labor Requirements (prevailing wages and apprenticeships) responsibilities to those we, or our clients, contract. See example in the addendum. Please note the IRS has issued new guidance on Prevailing Wage & Apprenticeship in June 2024, the example addendum does not reflect the new information.

FINDING TAX COUNSEL

The tax credits under the IRA are nuanced and are newly available for Counties and other tax-exempt entities to take advantage of. McKinstry is not licensed or insured to provide financial or tax advice, we recommend hiring an experienced tax advisor to handle the process of filing for the tax credits with the IRS. McKinstry can support and provide relevant project information through the entire process, and we have a tax advisor we recommend, Ryan LLC (no obligation to use), though we know they have experience in this area with some of our other clients.