Case Study of a Solar and Weatherization Retrofit of Rural Cold Climate Senior Affordable Housing

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ABSTRACT

There are significant opportunities for the same development project to leverage traditional affordable housing funding resources and sustainable buildings resources. Accessing both categories of funding programs can allow a project to be financially feasible, protect against energy inflation, and create efficiencies that increase cash flow by reducing operating costs. In addition to supporting property operations there are also opportunities to further improve the overall affordability of an affordable housing property by directly reducing the energy costs paid by residents.

The Brodhead Senior Village Solar and Weatherization retrofit project is a case study example of an active project that leverages currently available funding programs to support the weatherization, roof replacement and installation of a 106 kW rooftop solar system at an 18 year old rural senior affordable housing property. With no upfront cash cost to the property owner, the approximately $1 million project improves the property's cash flow by significantly reducing electricity costs, provides long term protection against inflation of energy costs, and also directly improves housing affordability by saving low-income senior households approximately $475/year/unit. For the non-profit organization property owner, reducing resident energy costs was the major driver of this project.

This project's financial structure is widely replicable due to its primary utilization of U.S. federal government programs (solar Investment Tax Credits/Direct Pay, Weatherization Assistance Program, HUD Section 4 and Capital Magnet Funds), which are available across the country. Additionally, the major component of the state specific project funding is also broadly available via each state's Housing Finance Agency: a below market fixed rate 35 year amortizing affordable housing mortgage. While the feasibility of comparable projects may vary due to local conditions (solar net metering policy, zoning, electricity cost, etc.) and interest rate sensitivity, generally this project's financial structure can be an effective model for non-profit affordable housing property owners and developers who wish to reduce building operating costs as well as resident-paid electricity costs.

Introduction

Brodhead Senior Village is a 24 unit senior affordable housing property located in the rural community of Brodhead, WI (population 3,274)[1] and owned by regional non-profit organization Southwestern Wisconsin Community Action Program (SWCAP). The townhome property was originally constructed utilizing the Low Income Housing Tax Credit (LIHTC)

[1] 2020 U.S. Census population (United States Census Bureau 2024).

program in 2006 and contains a mix of units affordable to senior households at 50% and 60% of the Area Median Income as well as two "market rate" units with no income restrictions. In 2022 all resident households at the property had annual incomes of less than $30,000. There is an active HOME loan on the property that dates back to the property's original construction; otherwise there was no active subsidy program serving the project when SWCAP began investigating solar and energy efficiency upgrade opportunities.

In partnership with Front Door Development, LLC,[2] property owner SWCAP investigated various options and determined a scope of work and funding strategy that required no upfront cash investment, utilized actively available funding programs, and reduces the property's total utility costs by an anticipated 27% in year 1, saving the property over $5,500 annually. In addition residents of the property will realize individual savings on their utility bills estimated to be over $475 annually per unit. To achieve these savings, in addition to the roof replacement the property installed a 106 kW rooftop solar system with direct interconnections to all resident electric meters and property common meters, and replaced the leasing office furnace with a high efficiency model.[3] The project also accessed the federal Weatherization Assistance Program (WAP) to install a number of basic energy efficiency measures including additional R-30 insulation in the attic, air sealing, LED light bulbs, and high efficiency bathroom fans.

Figure 1. Brodhead Senior Village 106 KW solar installation. *Source: Midwest Solar Power LLC*

[2] Front Door Development, LLC is a development consultant based in Hugo, MN specializing in affordable housing and housing sustainability projects for mission-oriented organizations (Front Door Development, LLC 2024).
[3] The property's HVAC system consists of a centralized gas boiler system per building, in addition to a gas furnace that supports the leasing office and a single through-the-wall AC unit in each resident unit. The project investigated various alternative heating options including installing site geothermal, replacing HVAC with higher efficiency models, and electrification including converting to heat pump boilers or mini splits and utilizing a heat pump for the leasing office, but all were found to be infeasible either due to cost (geothermal, replacing boilers), technology compatibility issues (geothermal incompatible with existing boiler systems), or technology reliability issues (heat pumps would not be effective in Wisconsin winter conditions, and their installation was not recommended by the Weatherization Assistance Program provider).

Case Study Process and Findings: Pre-Development and Scope Evaluation

A Capital Needs Assessment (CNA) report was procured at project initiation in order to provide a third-party assessment of the property's long term capital needs, as well as to complete a requirement making the project eligible for a state Housing Finance Agency mortgage. The CNA was completed by a local licensed architect familiar with affordable housing properties and approved by the Wisconsin Housing and Economic Development Authority.[4] Property management and ownership staff and resident comments on site condition, typical maintenance schedules and planned capital projects were also obtained. The resulting scope of work and associated costs accounted for all anticipated capital costs for the next 20 years that were outside of the property's planned maintenance scope and existing replacement reserves capacity. The CNA determined that largest impending capital needs cost was the needed roof replacement. Once the basic property needs were accounted for the evaluation proceeded to potential sustainability upgrades.

To evaluate the cost and benefits of a rooftop solar installation, the development team first assessed the property's solar potential using the PVWatts online tool,[5] which determined that there was sufficient solar exposure, available roof space and effective roof orientation to support an efficient photovoltaic system. The remaining life of the roofing was not necessary to evaluate due to the roof replacement already being included in the scope of work. Next the local utility's net metering policy and rate structure were evaluated and shown to be favorable (i.e. a 1 to 1 net metering policy and a fixed rate per kWh charging model).

Solar contractor Midwest Solar Power LLC was then procured to design a system that maximized the available roof and transformer capacity and included separate, equally sized systems for each resident as well as systems directly tied to the property common meters. The contractor's engineer also confirmed that the building could support the weight of the solar system with no structural upgrades. The resulting design included a 106 kW system distributed on the property's three buildings; Enphase micro inverters and JA Solar 405 watt bifacial PV panels were utilized. The below site plan (Figure 2.) illustrates the final solar design for the property, which included a mix of residential and commercial systems sited next to each other.

[4] A WHEDA-approved Capital Needs Assessment is a prerequisite to accessing any WHEDA loan for a project involving existing housing (Wisconsin Housing and Economic Development Authority 2024). The CNA was performed by Jerry Bourquin, AIA, Dimension IV-Madison.

[5] NREL PVWatts Calculator, https://pvwatts.nrel.gov/. This simple tool can be navigated by a layperson and allows one to measure the available roof space in a particular location and generate an estimate for the size of solar system that could fit in this space and the amount of energy it will generate on a monthly basis (National Renewable Energy Laboratory 2024).

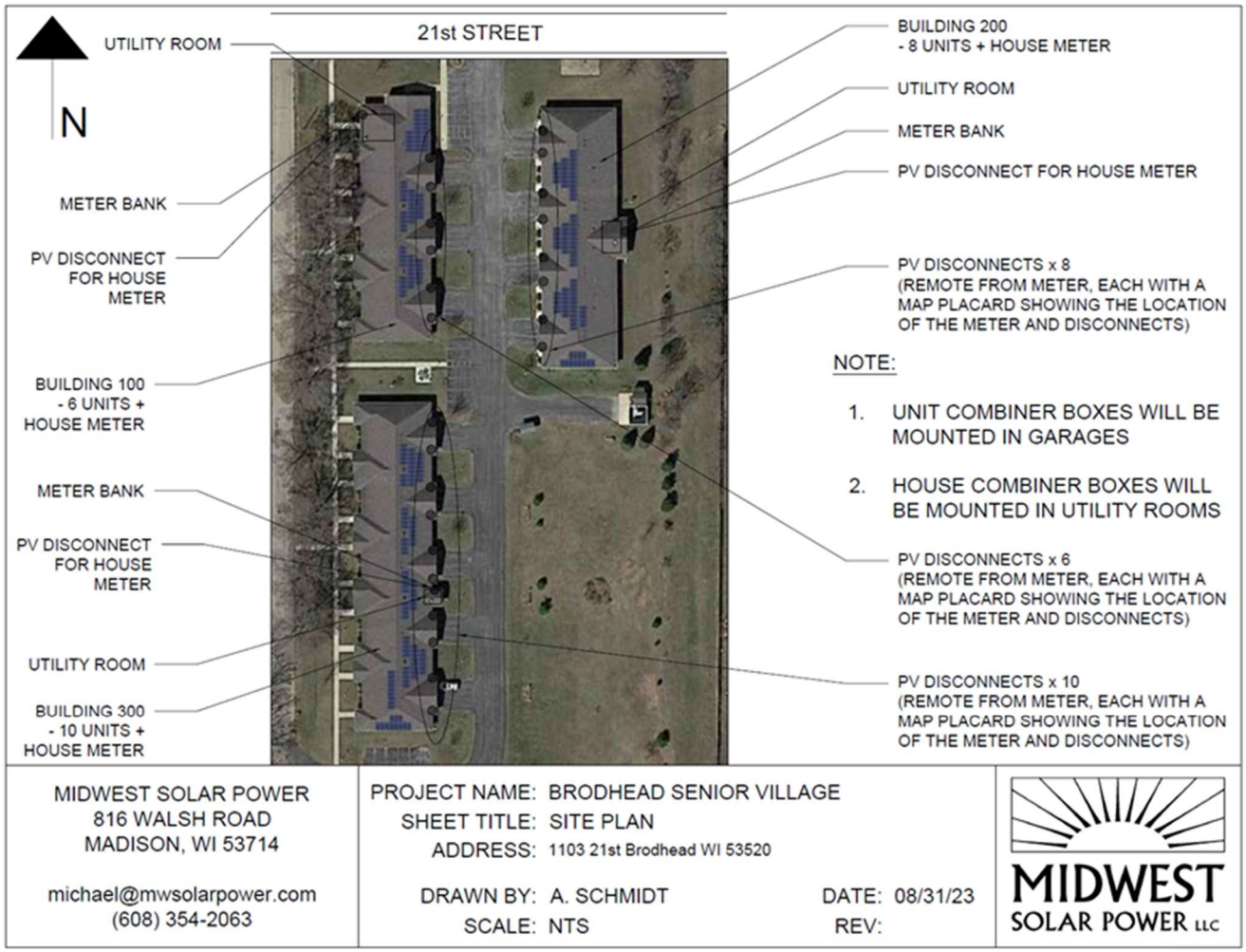

Figure 2. Brodhead Senior Village solar site plan. *Source: Midwest Solar Power LLC*

With the system design and cost known, the available capital subsidy sources dependent on system sizing and cost were then calculated (i.e. Solar Investment Tax Credit proceeds). In addition, anticipated monthly cash flows due to energy cost offset and net meter proceeds were calculated based on system production and current electricity pricing. Cash flows for both residents and property owner were measured.

Costs and benefits associated with the energy efficiency upgrades were calculated by Weatherization Assistance Program (WAP) partner Project Home, Inc.[6] Project Home designed the scope of work for this portion of the project based on the results of an initial energy audit, as well as the WAP program requirements and locally available WAP program resources (Project Home, Inc. 2024). Front Door Development, LLC provided project financial structuring and development team project management.

[6] Project Home is the regional administrator for the Weatherization Assistance Program (WAP), a federal low income energy efficiency program that partially covers the cost of energy efficiency improvements (U.S. Department of Energy Office of State and Community Energy Program 2024).

Case Study Process and Findings: Project Financing

The Brodhead Senior Village Solar and Weatherization project began in early 2022 when SWCAP received news from the property manager that the property's roof needed replacement and the parking lot needed repairs, and the property did not have enough replacement reserves available to fund the work. This need to access funding to support major roof and parking lot work initiated a search for low-cost funding opportunities that would allow the property to complete the needed work while continuing to offer very low rents.[7] Given the amount of effort and soft costs (legal, financing and title costs, staff time) required to execute the necessary financing and construction work, SWCAP decided to also evaluate potential additional property upgrades that could bring in new low-cost sources of funding and also reduce property operating costs, as a reduction in operating costs would allow the property to support additional debt to support the project costs. Further, as a mission-driven non-profit organization, SWCAP was interested in upgrades that would reduce residents' utility costs and make their total cost of housing more affordable.[8]

To accomplish this project with no out of pocket cost to SWCAP, the development team structured the project to take advantage of a variety of funding programs including public and private grants and below market loans only available to affordable housing or renewable energy projects. The project leveraged the property's accumulated equity and refinanced the first mortgage with a new 35 year fixed rate below market mortgage via WHEDA, with proceeds from the refinancing used to fund the project. WHEDA also provided an allocation of federal Capital Magnet Funds (CMF) as a cash flow only loan[9] at a 3.0% rate, matching the 35 year first mortgage term. Capital Magnet Funds are a federally allocated affordable housing funding source administered by state Housing Finance Agencies (U.S. Department of the Treasury Community Development Financial Institutions Fund 2024). Additional funding sources included Direct Pay Solar Investment Tax Credits (ITC) including the 20% bonus adder for Category 3 Eligible Housing, solar grants including RENEW Wisconsin Solar for Good and Focus on Energy commercial and residential solar rebates, Weatherization Assistance Program (WAP) cost sharing, and a HUD Section 4 Rural Capacity Building grant. Construction period financing was provided by local CDFI lender Forward Community Investments.[10] These various capital funding sources are summarized in the following Table 1. Project Sources and Uses:

[7] A typical multifamily property would take out a loan to fund these repairs, and the loan payments would be supported by increasing tenant rents.

[8] Not every property owner is affordability-motivated. In addition to mission-driven affordability motivations, SWCAP benefits from the reduction of residents' utility costs as low-income residents have additional resources to support rent costs, reducing turnover. Lower Utility Allowances (UAs) also allow for the potential of future rent increases while staying under maximum rent limits.

[9] A cash flow only or "soft" loan cannot foreclose, and is only payable out of available cash flow after other property debt service and expenses have been paid.

[10] Construction period "bridge" financing is necessary to bridge the solar ITC and grant proceeds during construction of the system, particularly for a non-profit organization accessing ITC Direct Pay, where funding is not realized until the following year's tax return.

Table 1. Project Sources and Uses

SOURCES		USES	
WHEDA Mortgage (5.5%, 35 year fixed/am)	$586,000	Purchase Buildings and Land	$1
Capital Magnet Funds (3.0%, 35 year fixed/am)	$200,000	New Construction/Rehabilitation	$499,441
Solar ITC Direct Pay	$124,871	Contingency	$16,715
Focus on Energy Solar Rebates	$28,044	Permanent Loan Payoff, Fees and Costs	$269,159
		Construction Loan Fees and Expenses	$3,066
		Architect Fees	$3,850
		Legal	$8,000
		Title & Recording	$6,832
		Survey	$ 3,900
		Appraisal	$3,000
		Phase I Environmental Report	$7,300
		Misc. Soft Costs	$4,680
		Replacement Reserve	$87,321
		Operating Reserve	$25,650
TOTAL	**$938,915**		**$938,915**

NON-CAPITAL AND IN-KIND SOURCES	
Construction Loan (Forward Community Investments)	*$152,000*
Solar For Good In Kind Panel Donation (Reduces Install Cost)	*$25,466 (131 panels)*
HUD Section 4 Rural Capacity Building Grant (Technical Assistance and Support of SWCAP Staff Costs)	*$45,000*

WHEDA is the State of Wisconsin's Housing Finance Agency (HFA).[11] The WHEDA mortgage was the largest source of funds for the project. This loan was obtained via refinancing the property's existing mortgage, which had also been financed by WHEDA when the property

[11] Every state in the country has its own HFA, which develops local housing programs and also acts as a conduit for a variety of federal housing funding programs including Low Income Housing Tax Credits (LIHTC).

was originally constructed in 2006. This existing mortgage had no active prepayment penalty,[12] as the prepayment penalty period had ended 15 years after the initial loan closing. Thus, there was an opportunity to refinance the existing loan--which had a rate of 6.75%--at lower current rates and also draw on the property's accumulated equity created by 18 years of mortgage principal and interest payments. In addition to refinancing at a lower rate, loan payments were able to be resized to account for the solar and energy efficiency cost savings and push some of these savings towards loan repayment. The development team evaluated various lending partners and loan products and determined that WHEDA's 35 year fixed rate mortgage offered the most beneficial lending terms for the project. In addition WHEDA is a conduit for the federal resource of Capital Magnet Funds, and could provide these funds as a cash flow only loan to the project at a 3.0% rate. By blending these loan sources the project achieved a blended fixed rate of 4.86% on a loan principal of $786,000 with a 35 year term and amortization.

These WHEDA loan products are only available to affordable housing properties and offer low fixed rates and long terms, but also have several specific conditions that increase the complexity of the funding process. The WHEDA loans required the execution of a Land Use Restriction Agreement (LURA) to guarantee long-term rental affordability and maximum resident incomes, which extend the term of affordability for the property. Further, WHEDA's internal loan underwriting and approval process required the project to provide a number of documents, which necessitated the procurement of several professional reports and tests including a Capital Needs Assessment, Phase I Environmental Report including mold and radon testing, updated survey, appraisal, and legal opinion. These pre-loan reports required by WHEDA totaled over $18,000. These costs needed to be paid upfront by SWCAP and were reimbursed with loan proceeds at the loan closing. These loan approval requirements were uncommonly extensive for the project's scope of work (e.g. radon testing is not typically required for a solar loan); this is due to WHEDA having a single loan approval procedure and checklist for all its housing loans, with no distinction between projects such as this one with a relatively modest scope of work, and new construction or major rehabilitation ("gut-rehab") housing projects. The inflexibility of the loan underwriting checklist was one drawback to utilizing the WHEDA loan, as this added cost to the project. Additionally, WHEDA's lending policy would not allow for the project to include any developer fees or consultant costs in its budget, necessitating accessing other sources to cover project administrative and technical assistance costs. Despite these challenges the WHEDA financing terms were by far the most competitive for the project.[13]

The solar component of the project is eligible for Section 48 ITCs, which was significantly expanded in the 2022 Inflation Reduction Act, bringing the base ITC incentive level

[12] A prepayment penalty is a charge assessed by a lender for paying off certain loans early; this can be a very large cost that makes it infeasible for a loan to be refinanced.

[13] Various alternative lending sources were investigated including Property-Assessed Clean Energy (PACE), solar specific lending products, privately issued Government Sponsored Entity (GSE) backed mortgages, and 4% LIHTC/bonds; LIHTC was determined to have prohibitively high administrative costs for the project size and the project would have major difficulties locating a LIHTC investor, also due to small scale. The other loan options were not competitive with WHEDA terms.

to 30%.[14] The Inflation Reduction Act also authorized "Direct Pay",[15] which allows for some non-tax-paying entities including 501(c)3 non-profit organizations to receive a direct refund payment of the tax credits (Internal Revenue Service 2024). As an affordable housing property with active HOME Program funding, the project was eligible to apply for a 20% ITC low-income communities bonus adder allocation under the "Category 3 Eligible Housing" classification (U.S. Department of Energy Office of Energy Justice and Equity 2024). Furthermore, the project was eligible to apply under the "Additional Selection Criteria" due to being owned by a non-profit organization, which significantly reduced funding competition from other projects. This bonus ITC allocation application was submitted in the first available Department of Energy submission pool in October 2023 and received an allocation award notice in December 2023. The total value of these solar tax credits is $124,871,[16] which is calculated by multiplying the amount of the ITCs by the cost of the solar improvements. These funds will be received as a direct payment to SWCAP on the submission of their 2023 tax return. The solar ITCs are effectively a grant as they do not need to be paid back, and are the largest non-loan source of project funding. Without this source of funding the solar component of the project would not be feasible.

In addition to ITCs, the solar component of the project met the requirements for local solar funding programs RENEW Wisconsin Solar for Good and Focus on Energy. RENEW Wisconsin's Solar for Good program is an in kind donation of solar panels for non-profit-owned solar projects in Wisconsin. This competitive program reduced the cost of the solar installation directly by $25,466, or 131 solar panels (RENEW Wisconsin 2024). Focus on Energy is a consortium of the Wisconsin utility providers and offers a statewide solar rebate program of $500 per residential system, with a $500 bonus for rural housing projects (Focus on Energy 2024). These rebates were available to the project on a per unit basis as the solar is separately interconnected to each residential meter. Additionally the project qualified for Focus on Energy's commercial solar rebate for the common meter-tied components of the project, bringing the total rebate value to $28,044. These rebates were applied for and reserved prior to the project's financial closing, but are not paid out until after the completion of the solar installation.

Due to the delayed timing of the ITC payment and solar Focus on Energy grants, the project must support a period of over a year in which the solar installation costs have to be paid prior to the ITC proceeds being available. To accomplish this, the project obtained a construction period loan facility in the amount of $152,000 from non-profit CDFI lender Forward Community Investments. Interest-only payments are due monthly on the loan principal as it is drawn, and the loan balance will be fully repaid in late 2024 when the ITC proceeds are received. These financing costs are incorporated in the project budget and are necessary in order to utilize the value of the solar ITCs and rebate funds.

A crucial source of funding not noted in the above Sources and Uses table is the federal Weatherization Assistance Program (WAP). This program directly reduced the project's

[14] Solar projects under 1 MW are exempt from meeting prevailing wage requirements and automatically achieve a 30% base ITC.
[15] Also referred to as "elective pay".
[16] This is a conservative estimate of the ITC proceeds, based only on solar construction costs. The soft cost ITC basis of the project is currently under accountant review, and the final ITC amount is anticipated to be higher.

construction costs. For eligible properties in Wisconsin this program supports 85% of the cost of Weatherization improvements including air sealing and insulation installation.[17] WAP is a federal program via the Department of Energy, but regional non-profit organizations administer the program locally including performing the WAP energy audit and construction work. While the WAP program is best known for addressing properties owned by low-income households such as single family homes, rental affordable housing properties are often eligible. In order to be eligible, over 50% of a property's residents must be signed up for Energy Assistance prior to applying for WAP. Energy Assistance is a separate program that provides a one-time energy bill subsidy directly to low income households during the heating season (October-May). Thus the development team worked with local WAP administrator Project Home, Inc. and property management staff to sign up Brodhead Senior Village residents for Energy Assistance in order to obtain property eligibility for WAP. This annual payment was an added benefit of the project for property residents. With WAP eligibility obtained, the property qualifies for nearly $64,000 of energy efficiency improvements for a net cost to the project of $9,547. These improvements include air sealing attics, adding R-30 cellulose insulation to existing attic insulation, replacing each unit's existing bath fan and heat lamp with a high efficiency fan and LED light, rerunning bath ventilation through the roof, repairing minor gas leaks in boiler rooms, and LED bulb replacement throughout the property. Project Home completed this Weatherization work in April, 2024.[18]

The last source of project funding was a U.S. Housing and Urban Development (HUD) Section 4 Rural Capacity Building Grant in the amount of $45,000, which was used to support the project administrative costs including SWCAP staff time and consultant technical assistance disallowed by the WHEDA loan. This grant program is administered by Enterprise Community Partners on behalf of HUD. The project relied on SWCAP's status as a Community Housing Development Organization (CHDO) to be eligible for this competitive grant (Enterprise Community Partners 2024).

Case Study Process and Findings: Project Timeline & Energy Savings

Obtaining the necessary funding resources and meeting the various funding program hurdles, constraints, and submittal requirements has been the primary driver for the project timeline. The project closed on its financing package with WHEDA and FCI in June 2023. The roof replacement and parking lot repairs occurred in late summer and fall 2023. The solar installation was completed and interconnected January 2024, and the Weatherization work was completed in April 2024. The project will then claim the ITCs on its 2024 tax return (to be submitted in 2025) and pay off the construction loan once these funds are received from the federal government.

[17] While WAP is a federal program, each state has different priorities and formulas for project funding.
[18] Weatherization work involves attic insulation, which is best installed after solar installation work has been completed and all the conduits have been run; this, Project Home availability, and the Wisconsin winter weather determined the WAP installation schedule.

Table 2. Project Timeline

Project Timeline	
Perform Capital Needs Assessment	June 2022
Submit WHEDA Loan Application; Reserve Focus on Energy Solar Rebates and Solar For Good Award	August 2022
Loan Closing	June 2023
Furnace Replacement	August 2023
Solar Permitting Approvals	September 2023
Solar ITC Bonus Allocation Application Submitted	October 2023
Roof Replacement and Parking Lot Repair	November 2023
Solar ITC Bonus Allocation Received	December 2023
Solar Installation Completion	January 2024
Weatherization Completion	April 2024
Receive Direct Pay ITCs; Pay Off Construction Loan	June 2025

Though the construction phase of the project is still currently active, the project anticipates that significant energy cost savings will be achieved by both the property owner and the property's residents, and these savings will be realized for the warrantied lifetime of the solar improvements (30 years). The property itself will save an anticipated $5,525 in year one, and this amount will increase annually if traditional energy source costs increase per the historical trend. Each residential household is expected to save $476 in year 1, representing over 80% savings on their electric bills. Total annual resident savings is anticipated to be $11,424 across all 24 units. Table 3 provides a summary of expected savings. As a mission-driven non-profit organization, it was vital to SWCAP to provide significant benefits directly to property residents in addition to the property owner capturing savings cash flows.

Real-time solar energy production and the associated savings is actively being monitored by SWCAP and property management staff utilizing the web application provided by the solar inverter manufacturer Enphase. As the solar continues to operate more complete data will become available on the function of the system and the actual amount of savings realized by the property owner and residents.

Table 3. Property Upgrades and Anticipated Energy Cost Savings[19]

Property Upgrade	Annual Energy Cost Savings (Property)	Annual Energy Cost Savings (Per Resident)	Annual Energy Cost Savings (All Residents)
106 kW rooftop solar system	$3,605	$388	$9,312
Weatherization (insulation/air sealing, LED lighting, fans)	$1,920	$88	$2,112
TOTAL	$5,525	$476	$11,424

Conclusions

By leveraging various affordable housing and sustainability focused incentive programs the project did not require any upfront cash investment by the property owner. Crucially, the project leverages a mix of both affordable housing program resources including the Weatherization Assistance Program, Capital Magnet Funds, a HUD Section 4 grant, and a 35 year fixed rate mortgage provided by the state Housing Finance Agency, as well as several solar incentive programs including the solar Investment Tax Credit (direct pay), RENEW Wisconsin Solar For Good, and Focus on Energy solar rebates.

The project has resulted in significant energy cost savings for both the non-profit property owner and low income senior residents and is a replicable model. While local utility and zoning regulations, grant opportunities, and regional climate differences will affect local project feasibility and execution, the major funding sources in this case study project are widely available to non-profit affordable housing owners and developers across the United States.

[19] These savings are calculated using the Brodhead Water and Light charge of $0.1143/kWh and current 1 to 1 net metering policy. (Brodhead Water and Light 2024)

References & Resources for Further Reading

Brodhead Water and Light. 2024. “Rates.” https://www.brodheadwaterandlight.com/rates.

Enterprise Community Partners. 2024. “Section 4.” https://www.enterprisecommunity.org/impact-areas/partner-sustainability-and-growth/section-4.

Focus on Energy. 2024. “Solar for Homes.” https://focusonenergy.com/residential/solar-for-homes.

Front Door Development, LLC. 2024. “About.” https://www.frontdoordevelopment.com/about.

Internal Revenue Service. 2024. “Elective Pay and Transferability.” https://www.irs.gov/credits-deductions/elective-pay-and-transferability.

National Renewable Energy Laboratory. 2024. “PVWatts Calculator.” https://pvwatts.nrel.gov/index.php.

Project Home, Inc. 2024. “Weatherization Program.” https://www.projecthomewi.org/programs/weatherization/.

RENEW Wisconsin. 2024. “Solar for Good.” https://www.renewwisconsin.org/solarforgood/.

United States Census Bureau. 2024. “Brodhead city, Wisconsin Populations and People.” https://data.census.gov/all?q=Brodhead+city,+Wisconsin+Populations+and+People.

U.S. Department of Energy Office of Energy Justice and Equity. 2024. “Low-Income Communities Bonus Credit Program.” https://www.energy.gov/justice/low-income-communities-bonus-credit-program.

U.S. Department of Energy Office of State and Community Energy Programs. 2024. “Weatherization Assistance Program.” https://www.energy.gov/scep/wap/weatherization-assistance-program.

U.S. Department of the Treasury Community Development Financial Institutions Fund. 2024. “Capital Magnet Fund.” https://www.cdfifund.gov/programs-training/programs/cmf.

Wisconsin Housing and Economic Development Authority. 2024. “WHEDA Approved Capital Needs Assessment Provider List.” https://www.wheda.com/globalassets/documents/forms-manuals-resources/mf-financing-forms/cna-provider-list.pdf.