Solar 101

Minnesota NAHRO Conference
September 17, 2024

HOUSING SUSTAINABILITY ADVISORS

Minnesota Housing – Why do we care about solar?

- Governor's One Minnesota Plan and Climate Action Framework have goals to ensure clean, efficient and resilient buildings
- Strategic Plan sets the internal vision to Develop Energy-Efficient, Climate-Resilient, Sustainable Housing
- Internal Housing Decarbonization and Climate Action Plan gives specific action steps on how to decarbonize and make affordable housing climate resilient
- Sustainability Standards provide specific requirements and incentives to help spur investment in energy efficient, electric, decarbonized, and climate resilient affordable housing

Agenda

Solar 101: The basics of solar development and how it can help affordable housing

Solar Financing Case Study: Harbor Highlands Phase 6, Duluth HRA

Solar Program Opportunities:
MN Department of Commerce, Solar on Public Buildings Program
MN Housing, Solar and Decarbonization in the Publically Owned Housing Program (POHP)

Why Solar?

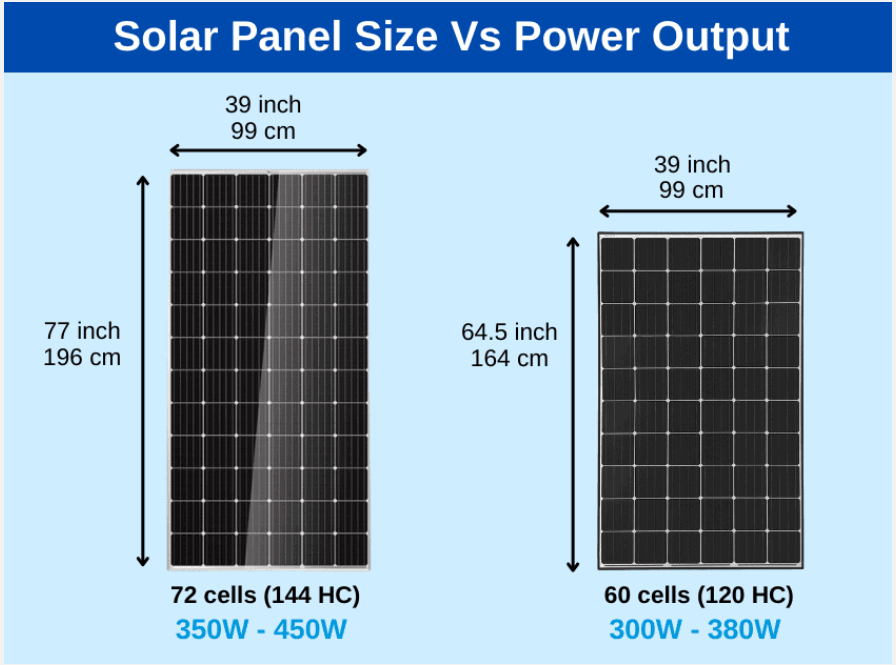
- Reduced Energy Costs
- Protection from Rising Electricity Prices
- Resident Savings
- Lots of Available Funding!
- Ability to Leverage Savings to Support other Goals
- Environmental Sustainability

Solar Equipment & Tech

Panels, Inverters, and Racking

Solar Panels

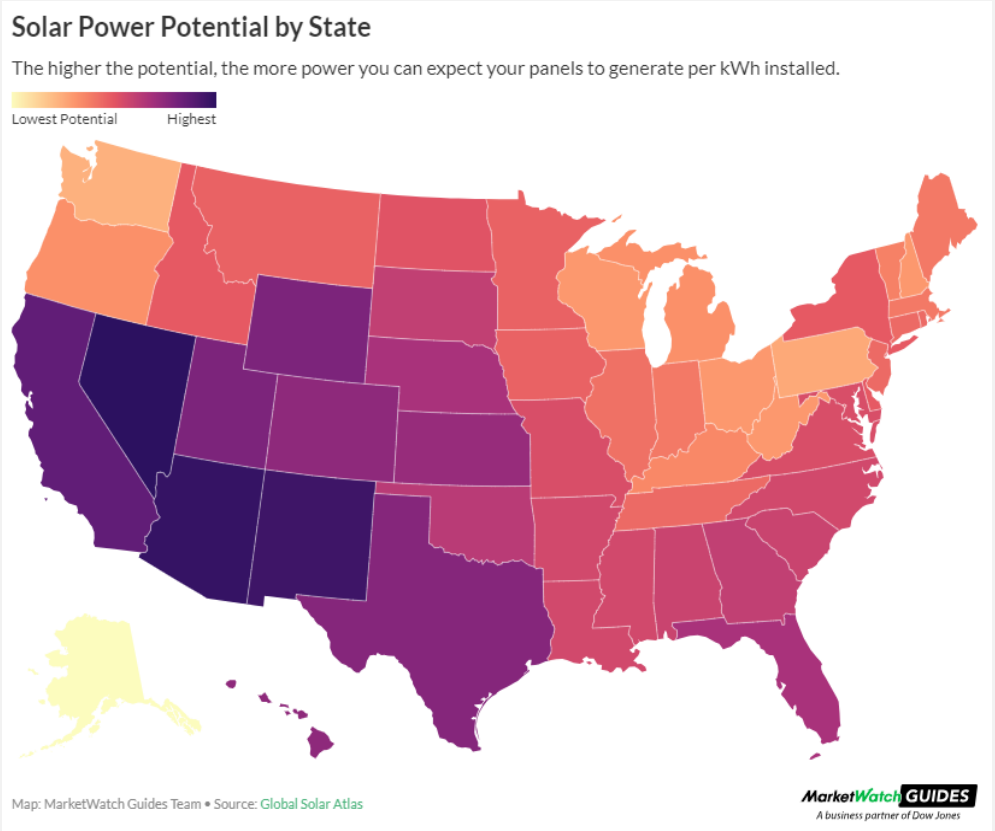
- Photovoltaic (PV), not Thermal!
- Harness the power of sunlight by converting it to electricity through a process known as the photovoltaic effect
- Panels come in various sizes
  - Vary in the number of cells
  - Vary in the amount of power they can produce
  - Most common panels for multifamily projects are 72 cells and 400+ watts
- Panels are becoming more efficient



Solar Panel Production

The amount of energy a solar panel can produce depends on several factors, including:

- Size and efficiency of the panel
- Availability of solar radiation
  - Geography
  - Time of year
- Orientation
  - South facing is best
- Shading/obstructions
  - Other buildings
  - Trees

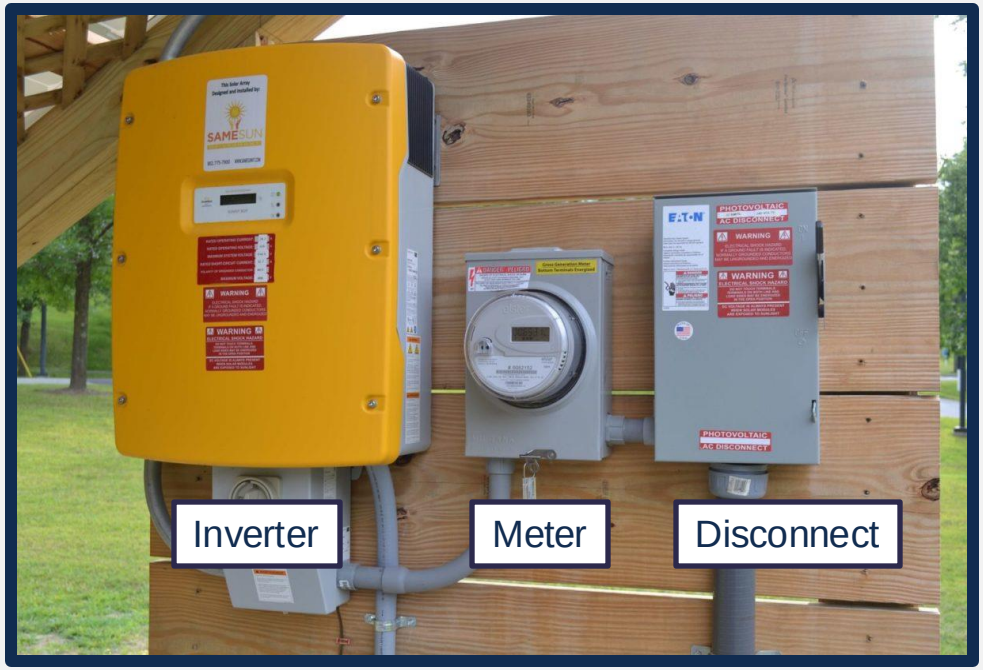


MN solar production potential is right in the middle

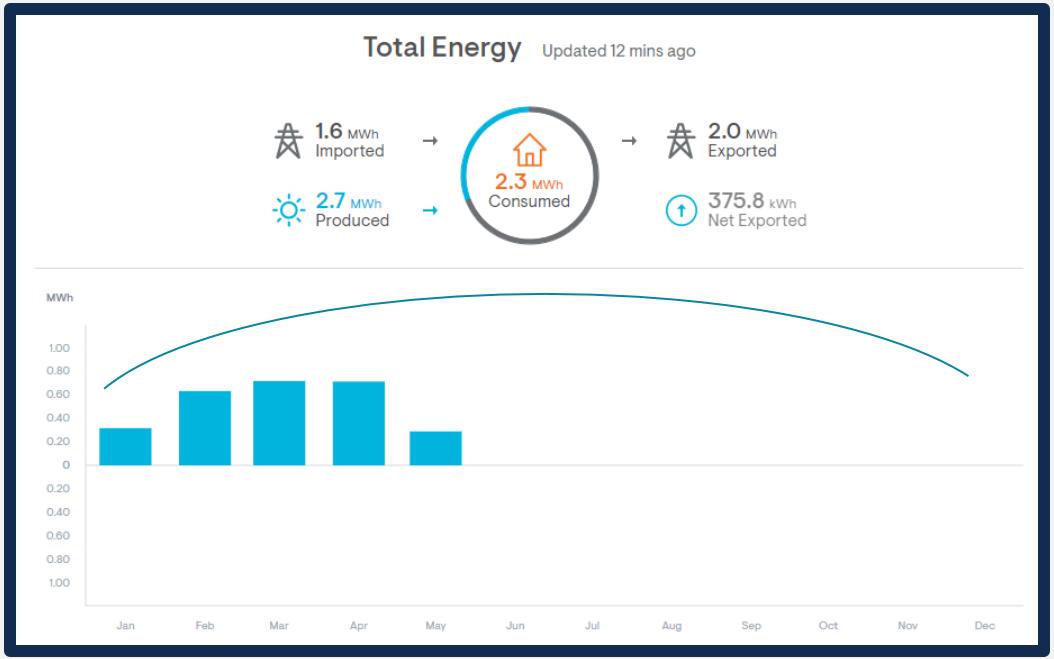
Inverters

The inverter is a key piece of equipment that:

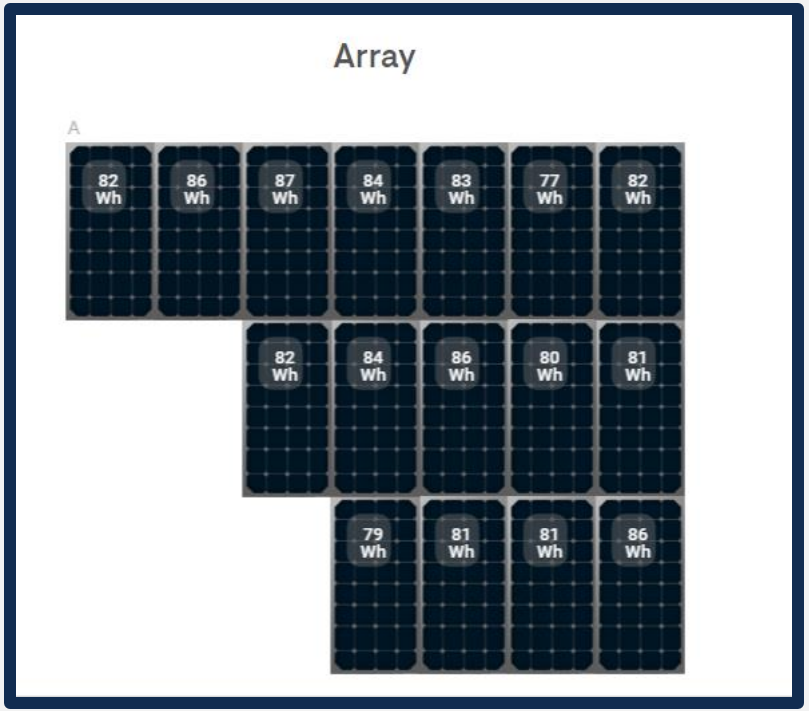
- Performs DC to AC conversion
- Allows for tracking and (remote) monitoring of the system's performance
- Come in different sizes (measured in watts) depending on the size of the solar system



Sample Inverter Data Collection



Production month to month



Status of each panel

Racking

The method by which solar panels are mounted for solar exposure

Three primary types:

- Rooftop
- Carport
- Ground Mount

Rooftop Solar

Mounted to flat roof

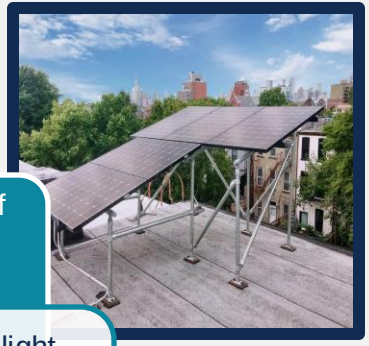
- ($) Ballasted – weighted blocks hold solar down
- ($) Mechanical attachments – roof penetrations hold solar down
- Depends on roof height and wind loads

Mounted to pitched roof

- ($) Rail System – solar mechanically attached, two rails hold solar to pitched roof
- Limited to roofs that receive ideal solar exposure

Raised off of flat roof

- ($$) Planar – light weight, raised off roof
- ($$$) Canopy – full canopy structure on top of roof
- Both allow roof work to be done and avoid roof obstructions



Carport Solar

Carports are elevated over surface parking spaces or on the upper deck of parking garages. **They are usually heavier and considerably more expensive** than other solar installations.

- Large steel beams are expensive to source and install, raising the price
- Wooden beams may be substituted, which may reduce price but only be viable in certain regions due to environmental considerations such as snowfall and wind
- Carports may sometimes be used in lieu of garages (depending on local regulations)

Ground-mounted Solar

Ground-mounted systems can vary based on racking used

- Pole-mounted (raised above the ground)
- Ballast-style racking (closer to the ground, but placed on an overall elevated surface)

Ground systems come with a unique set of diligence issues:

- Local zoning laws
- Clearing and grading (leveling) may be required
- Trenching may be required to connect the solar panels to an inverter or transformer far away
- Requires large, open spaces to be financially efficient

Solar System Costs

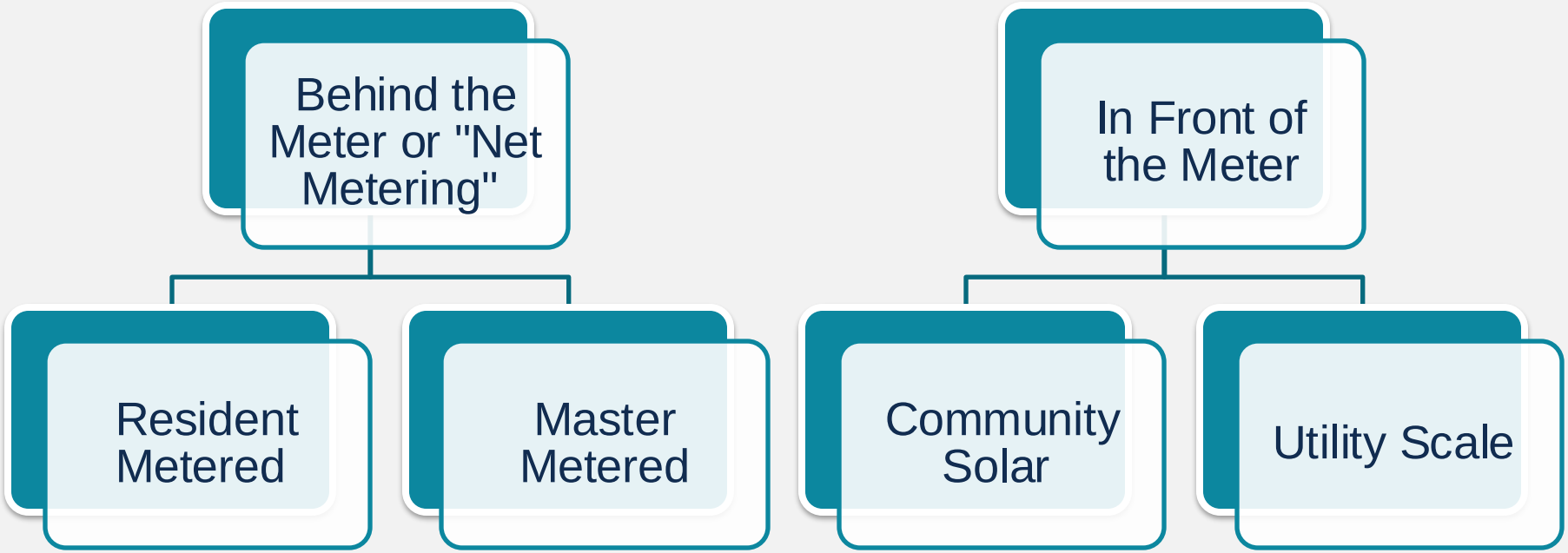
- Solar is priced typically on a $/Watt basis
  - Solar systems are sized in Kilowatts (kW), or 1000 Watts (W)
- “Turn key pricing" includes all design, permit, interconnection, equipment, materials and installation
- Pricing varies based on a number of factors including
  - Racking type
    - Carports = most expensive
    - Ballast = least expensive
  - Building height & property layout
  - System size
  - Interconnection complexity
  - Installer availability

Solar System Type	Anticipated Pricing
Ground Mount	$2.50/watt
Rooftop	$2.75/watt
Rooftop, multiple interconnections/ building	$3.00/watt
Rooftop Planar	$3.50/watt
Carport	$3.75/watt

Solar Metering

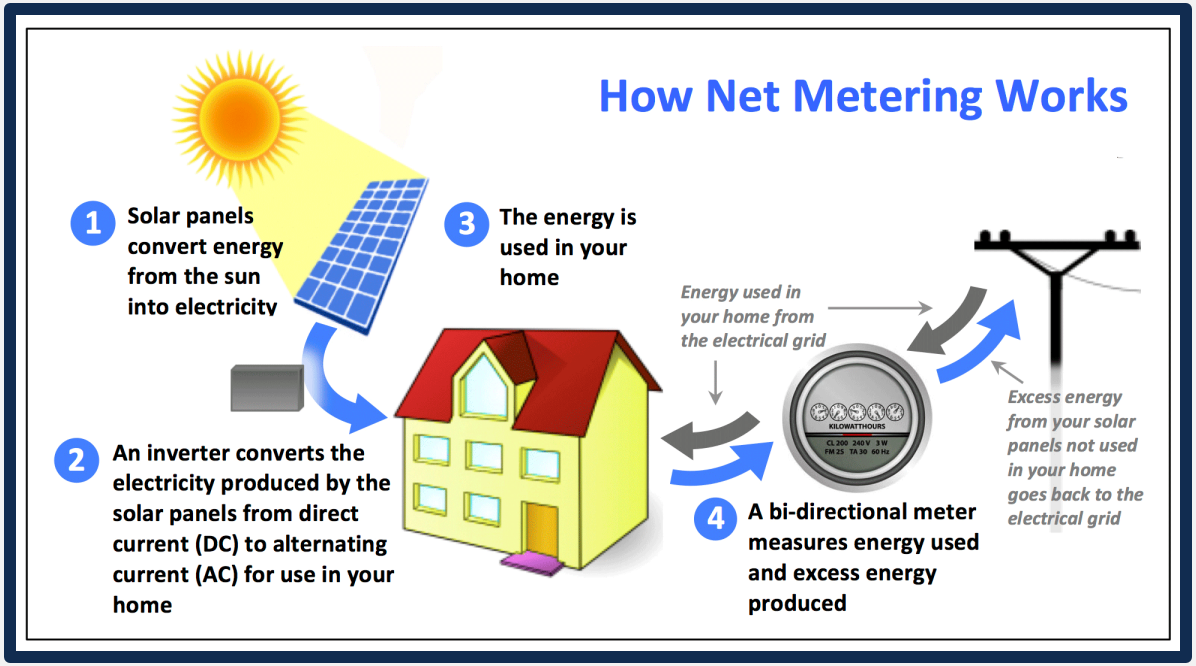
Behind the Meter vs Front of the Meter

Solar Metering Overview

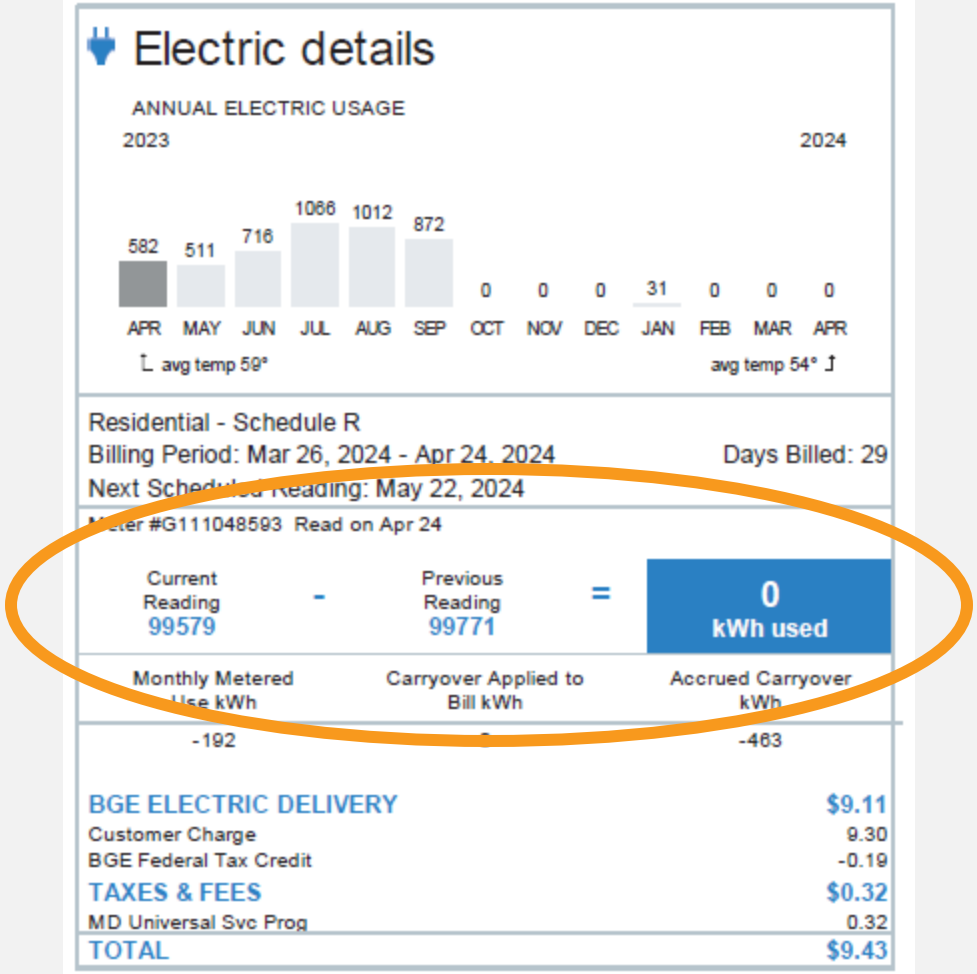


Behind the Meter or “Net Metering”

The energy that is produced and/or stored by these systems is separate from the grid



Sample “Net Metered” Electricity Bill with Solar



Behind the Meter – Master Metered

Owner pays for 100% of property utilities (common areas and units)

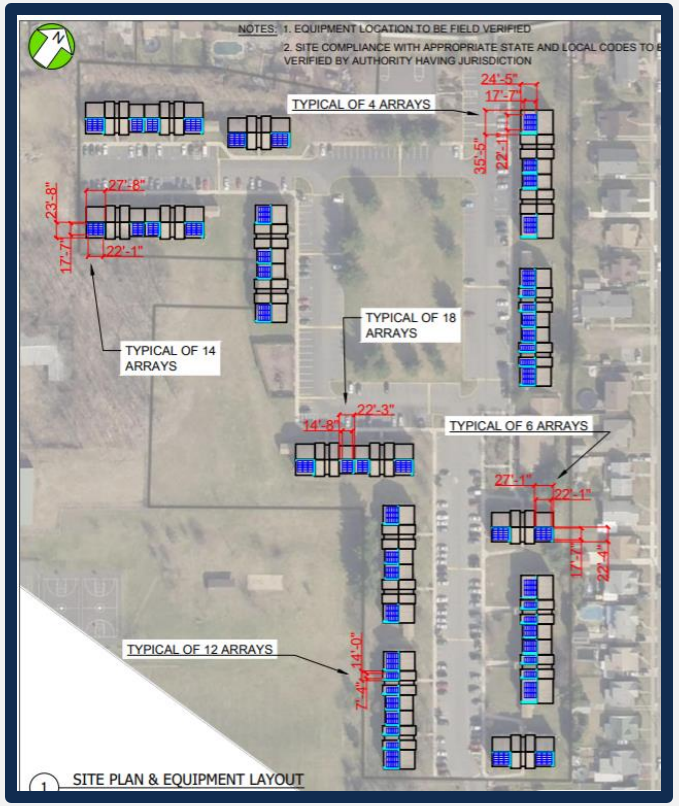
- On-site solar maximized to offset as much electricity as possible
- Owner directly captures all solar energy savings

Example: Project A
- Owner Electrical Load: 2,779,712 kwh/year
- Size of Solar Array: 1.6 MW
- Annual Solar Production: 1,945,798 kwh
- % of Owner Paid Load Offset: 70%

Behind the Meter – Resident Metered

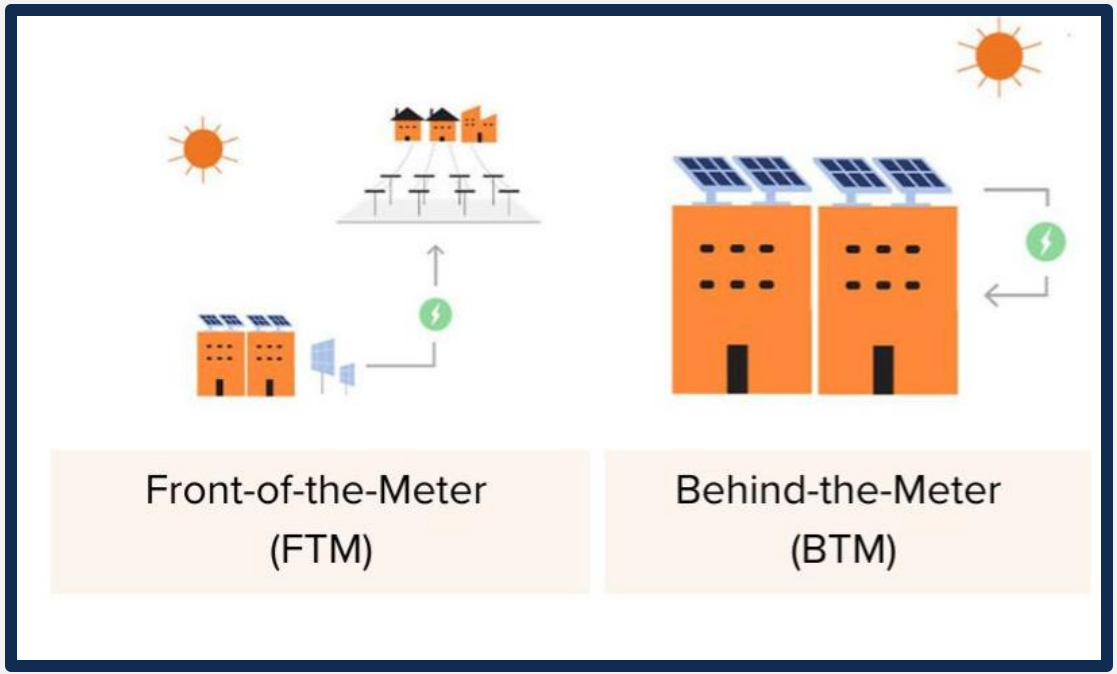
Residents pay the electric utility bills for their unit

- Solar can be sized to offset the owner-paid common area electric use only, resident unit electric use, or both
- One rooftop solar array can support multiple meters
- Common area usage offset results in direct owner operating savings
- Owner can capture some or all of resident savings by “taking back” the electric bill and/or adjusting the Utility Allowance



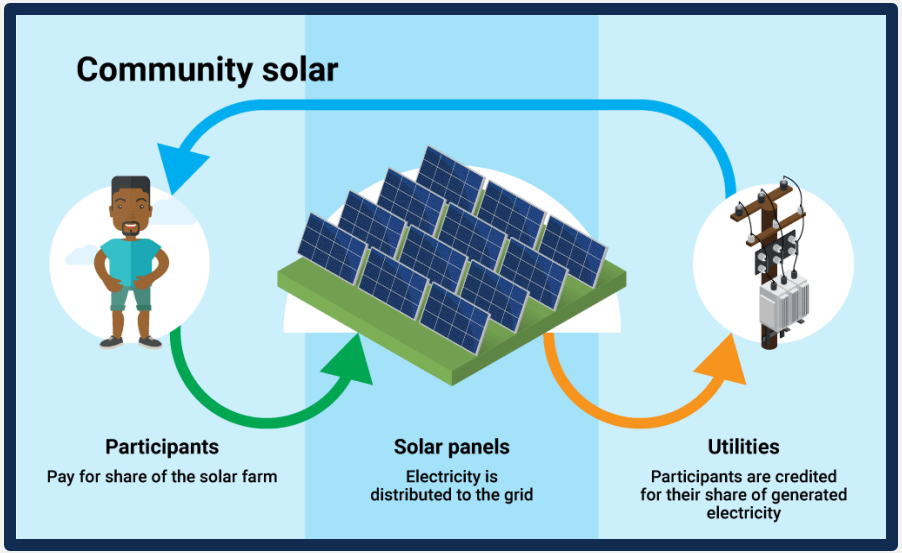
In Front of the Meter

- Energy generation and storage systems that feed the grid, as well as the power lines used to transport that energy, are considered to be front-of-meter

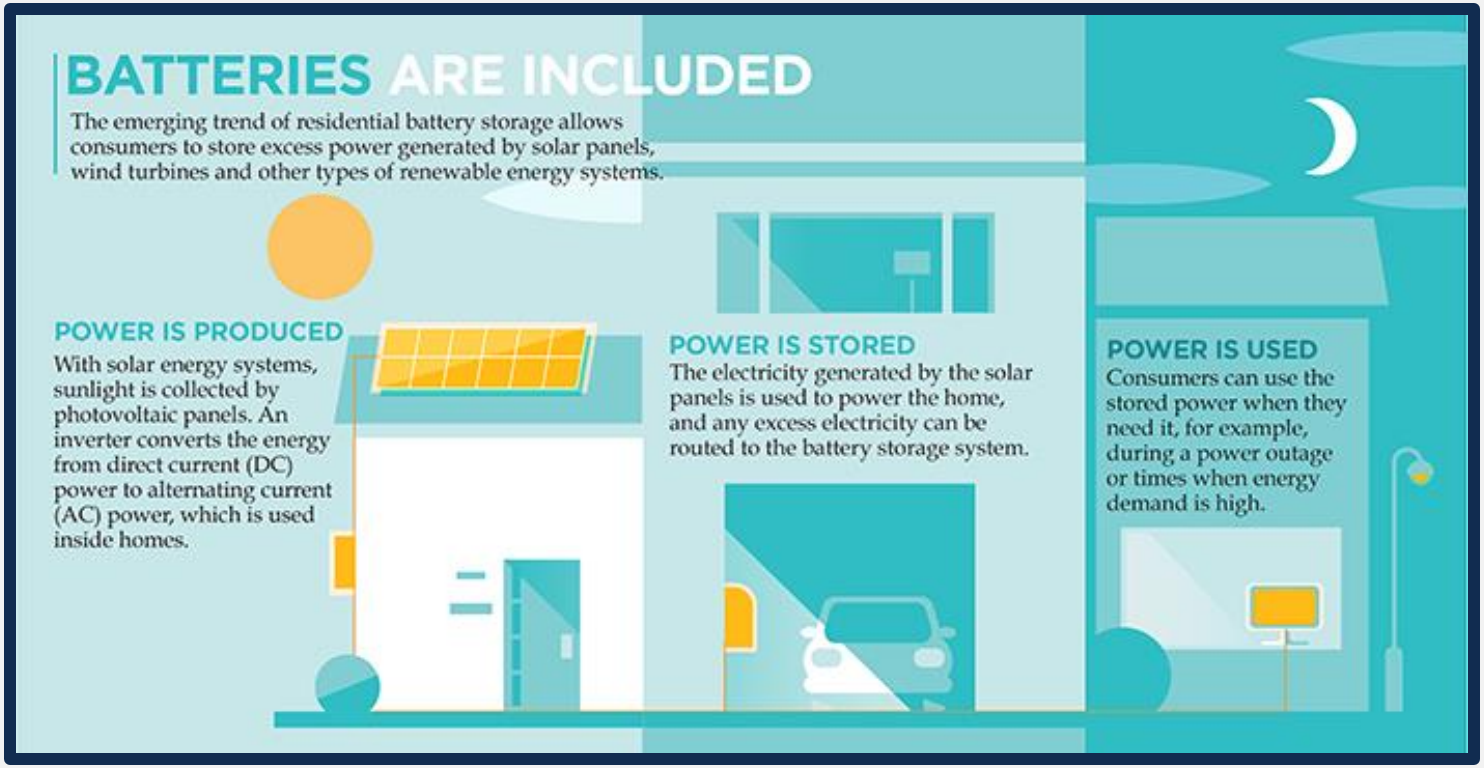


Community Solar

- Local solar facilities shared by multiple community subscribers who receive credit on their electricity bills for their share of the power produced
- Ideal for households that do not have access to solar because they rent, live in a multifamily building, or have roofs unable to host solar, or other limiting factors



Battery Storage



Operating Solar Post-Construction

Ensuring that systems perform as designed is key to ensuring that operational savings materialize and that the project cash flows correctly.

Strategies for ensuring performance include:

- O+M contract for the solar system that includes:
  - Annual site visits
  - Production monitoring
  - Maintenace + equipment replacements
- Remote monitoring
- Warranties on the following:
  - Panels: Tier 1 panels, 25+ year warranty
  - Inverters: 20+ years
  - 5+ year workmanship warranty
  - Roof systems: EPC works to extend existing roof warranty
- Production Guarantees
  - Written into the EPC contract requiring the EPC to financially guarantee 95% of the projected production

Is Your Project Solar Ready?

Solar Readiness Checklist and HUD Considerations

Solar Readiness Checklist – Multifamily Buildings

Solar Access

- ❑ Property has significant roof area that is either flat or oriented W, S, or E
- ❑ Roof is in full sunlight (not obscured by shade, i.e. trees) most of the day
- ❑ Roof-top equipment and vents leave available space for the solar

Structural Requirements

- ❑ New roof, or roof in good condition and under 5 years old
  - ❑ New construction, or a planned roof replacement is ideal!
- ❑ Roof can support the weight of a solar array (~5 lbs/SF)

Electrical Requirements

- ❑ Electric panel capacity, accessibility, available breaker space
- ❑ Transformer capacity

Solar and HUD

U.S. Department of Housing and Urban Development

Solar savings at HUD-supported properties are treated differently depending on the HUD program

Housing Choice Vouchers/Project Based Vouchers

- HUD does not need to approve a solar project at an HCV/PBV property
- All common area energy savings are captured by the property owner
- Ability to capture resident energy savings by adjusting Utility Allowance; can be done internally

Public Housing considerations

- Operating Subsidy adjustment — potential reduction due to solar energy savings
- Possible to capture 50%-100% of the savings, but requires HUD review and approval
  - Rate Reduction Incentive (RRI); Notice PIH 2022-34
  - Energy Performance Contracts (EPC); Notice: PIH-2024-27
- Repositioning programs (especially Section 18) can help!

HUD Guidance on Treatment of Resident Benefits

- HUD Memo: Treatment of Solar Credits in Master Metered Buildings in Public Housing (8/2/23)
- “Treatment of Financial Benefits to HUD-Assisted Tenants Resulting from Participation in Solar Programs (Notice H 2023–09)

Solar Financials

Incentives and Financing for Solar Projects

Solar Incentives in Minnesota

Tax Credits

- Solar Investment Tax Credits (ITC)
  - 30% base for projects < 1 MW
  - IRA related bonuses: 40% or better ITC for most affordable housing projects
  - Tax-exempt entities eligible for Direct Pay!

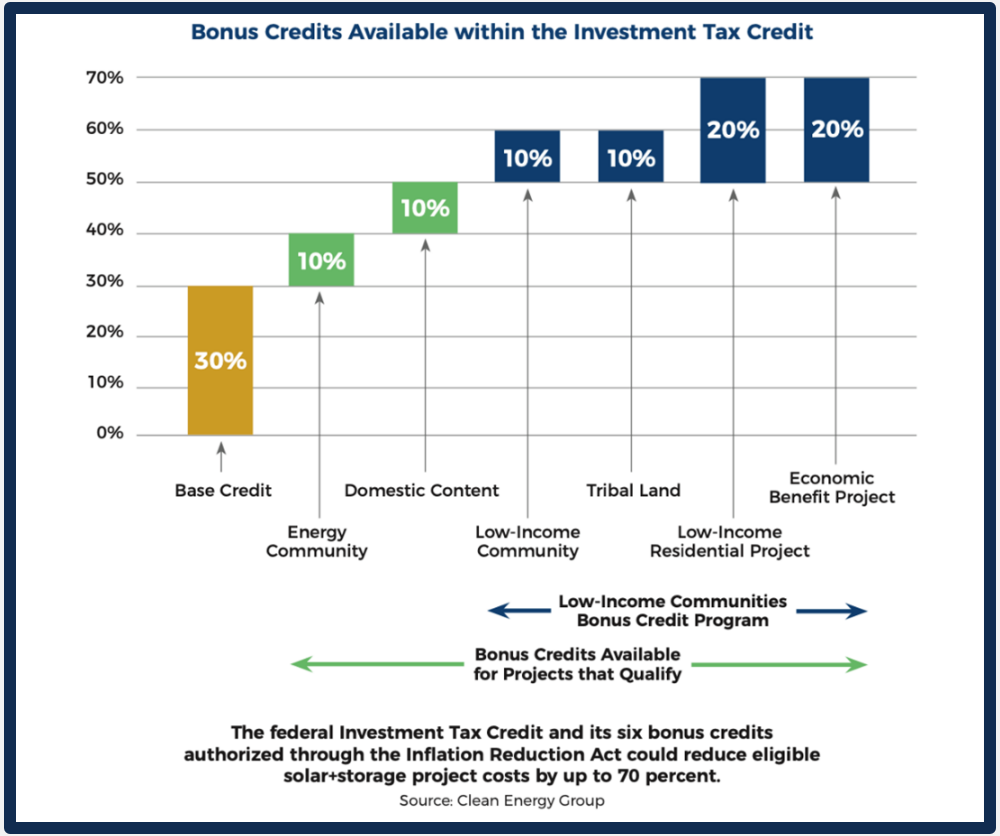
- Low Income Housing Tax Credits (LIHTC)
  - Solar cost included in project “basis”, generating LIHTCs
  - Extremely financially feasible--we highly recommended including solar in a LIHTC project

Upfront Grants

- Utility rebate programs
- Solar on Public Buildings (MN DoC)

Forthcoming Programs and Loan Options

- Solar For All (MN Dept of Commerce)
- NCIF
- CCIA
- MN CIFA



Bridge Loans

A “Bridge Loan” or “Construction Loan” provides the upfront funding for the solar installation, since incentives are typically not paid until the project is complete

- Short term (< 2 years), interest-only, paid back in full at the end of the project
- Available from banks, credit unions, public and non-profit lending organizations (i.e. MNHA, GMHF)
  - Loan program may not be “for solar”, but solar projects can still qualify
- Loan costs are included in project costs, generating tax credits
- Some organizations may have financial capacity to do an internal bridge loan

Solar Development Case Study

Duluth HRA: Harbor Highlands Phase 6

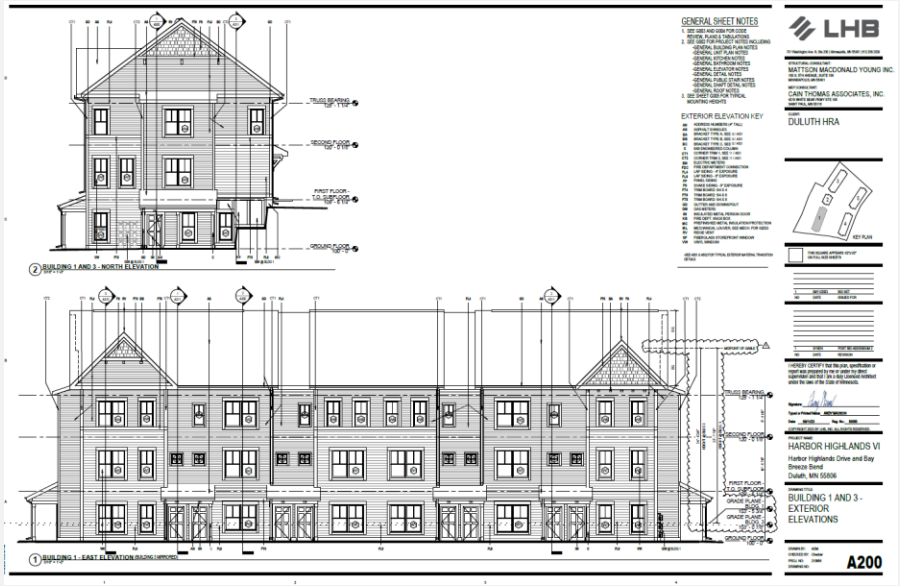
Harbor Highlands 6 Solar Strategy

Goals:

- Provide an initial solar sizing and strategy for the property
- Identify all incentives for solar
- Outline a strategy to incorporate and finance solar into the larger development deal

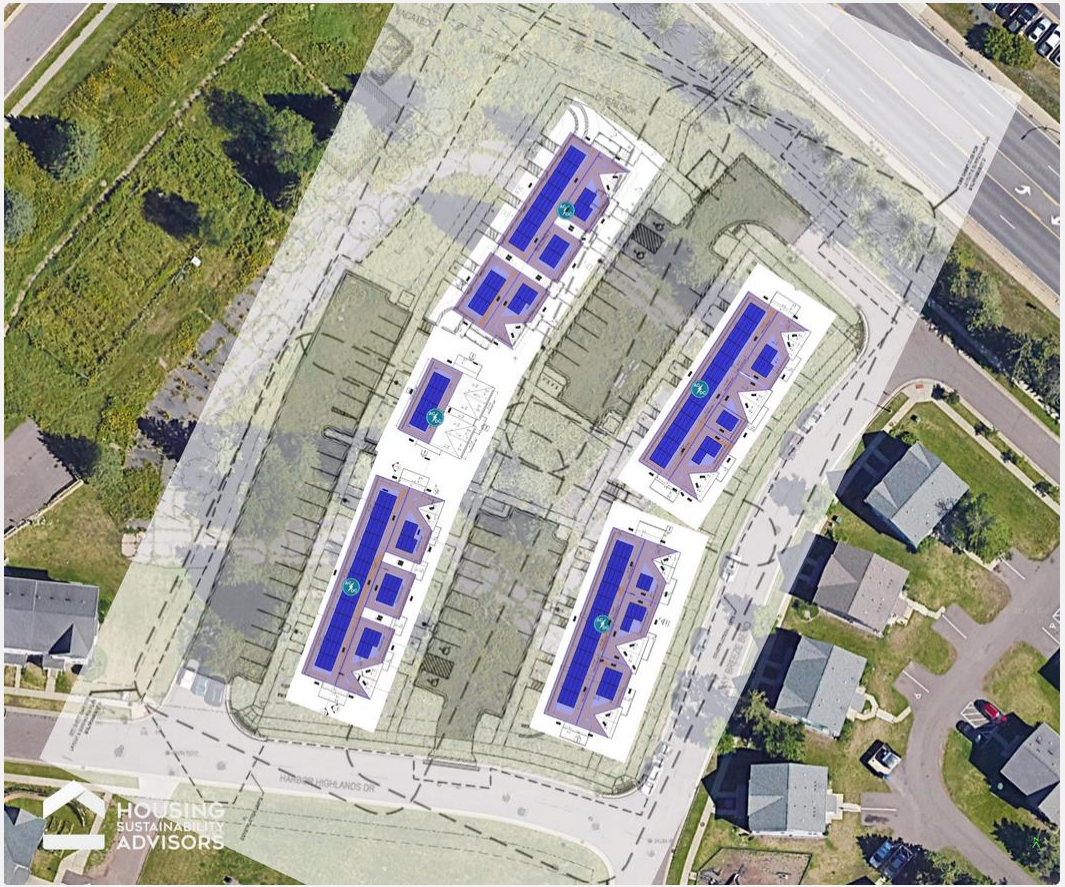
Property Details

- Address: Harbor Highlands Dr. and Bay Breeze Bend, Duluth, MN
- Unit Count: 40 units
- Property Type: 1- to 4-bedroom apartment units
- 9% LIHTC New Construction



Step 1: Solar Layout

- Determine roof condition
- Determine the optimal location for the solar array
- Model for total output of maximum potential system size



Step 2: Calculate Electric Usage

Tools to estimate electric usage:

- Old utility bills
- Property operating budget or audit
- Building electrical plans ("loads")
- Utility Allowances

Parking lot lights use lots of electricity!

ELECTRICAL SITE PLAN PHOTOMETRIC

Step 3: Solar System Sizing

- Compare output of solar to annual estimated energy usage
- Preliminary layout indicates we will be able to **offset roughly 30% of current total electricity usage**

PROPERTY	SOLAR SYSTEM SIZE (kWDC)	ANNUAL ESTIMATED USAGE (kWh)	ANNUAL SOLAR PRODUCTION (kWh)	USAGE AFTER OFFSET (kWh)	SOLAR OFFSET %	ANNUAL SOLAR OFFSET VALUE
Harbor Highlands 6	140.7	472,332	139,736	332,596	30%	$ 13,139
PROPERTY TOTAL	140.7	472,332	139,736	332,596	30%	$ 13,139

Step 4: Solar System Cost

SOLAR SYSTEM COSTS			
PROPERTY	SOLAR SYSTEM SIZE (kW)	SOLAR COST	
Harbor Highlands 6	140.7	$	422,100
-	-	$	-
TOTAL	**140.7**	**$**	**422,100**

"Back of the Envelope" solar cost estimates:

SOLAR SYSTEM COSTS			
			NOTES
Rooftop Solar Cost / Watt	$	2.75	
Rooftop Solar Cost / Watt	$	3.00	Upcharge for multiple interconnections/property
Carport Solar Cost / Watt	$	3.75	
Groundmount Solar Cost / Watt	$	2.50	

Step 5: Review Solar Incentives

MAX POTENTIAL SOURCES		USES	
$ 211,050	Investment Tax Credits (ITC)	$ 422,100	Solar Installation
$ 322,907	LIHTC Proceeds		
$ 146,817	Additional Loan Proceeds		
$ -	Minnesota Power Income Qualified Solar Program		
$ -	NEEDED Gap Funding		
$ 680,774		**$ 422,100**	

ITC		
	%	NOTES
Base ITC %	30%	Under 1 MW
Low Income Communities Adder %	20%	Category 3, Qualified Low-Income Residential Building Project
Domestic Content	0%	Not assumed
Energy Communities	0%	Not in Energy Community
TOTAL ITC %	50%	
DIRECT PAY ELIGIBLE?	YES	

Potential Perm Loan Raised from Solar Energy Savings	
Annual Solar Utility Savings	$13,040
Resident Savings %	$0
First Mortgage Debt Coverage	1.15
Available for Debt Service	$11,339
Interest Rate	7.00%
Amoritization	35
Additional Loan Proceeds Generated by Solar Savings	$146,817

Step 6: Solar Financial Summary

To make a decision on whether to install solar for this property, we are looking for:

- Net cash flow/savings
- Payback period
- Internal Rate of Return

Solar operating savings and incentives = cash flow!

Cash flow may be used to fund other activities at the property

Financial Analysis

		Bonus Federal ITC
		50%
System Details		
KW		140.70
Production Coefficient		1,100
Annual Production (kwh)		139,736
Electricity Value ($/kwh)		$0.09332
Annual Savings		$13,040.16
Savings Escalation		3%
Total Install Cost		$422,100
Federal Solar Investment Tax Credits (ITC)		
Federal Solar Tax Credit Basis		$422,100
Federal Tax Credit Percentage		50%
ITC Pricing		$ 1.00
Federal Tax Credits		$211,050
LIHTC Basis Boost		
LIHTC Eligible Basis		$422,100
LIHTC Basis Boost QCT or DDA (30%)		$0
Annual LIHTC Basis	9%	$37,989
Total LIHTC Basis (10 years)		$379,890.00
$/credit (State + Federal)		$0.85
LIHTC Tax Credit Value		$322,907

	Solar Investment Tax Credit Bonus
Capital Investment	($422,100)
Federal Solar Tax Credit	$211,050
LIHTC Credits	$322,907
Net Upfront Income/(Expense)	**$111,857**
Annual Savings	$13,040
Net Cash Flow	$610,766

Solar Incentives Without LIHTC

MAX POTENTIAL SOURCES			USES		
$	211,050	Investment Tax Credits (ITC)	$	422,100	Solar Installation
$	-	LIHTC Proceeds			
$	146,817	Additional Loan Proceeds			
$	-	Minnesota Power Income Qualified Solar Program			
$	64,233	NEEDED Gap Funding			
$	**422,100**		**$**	**422,100**	

Solar On Public Buildings Program

Andrew Ulasich
Solar on Public Buildings – Program Administrator

MN Department of Commerce

Solar on Public Buildings – MN State Grant Program

Eligibility

4.3M to be distributed in state grants for solar arrays:

- Local units of government: county, statutory or home rule charter city, town, or other local government jurisdiction (excluding school districts), as well as federally recognized Indian Tribes in Minnesota.
- On or adjacent to a publicly owned and operated building.
- In Xcel Energy electric service territory.
- Capacity that is lesser of 40kW or 120% average annual electricity usage

Maximum Allowable Grant

Adjusted Net Tax Capacity (ANTC) / Capita*	% System Cost (Up to)	Not to Exceed
Under $1,000	70%	$84,000
>$1,000	60%	$72,000
>$2,000	50%	$60,000
>$3,500	40%	$48,000
>$4,500	30%	$36,000
Tribal Nation	70%	$84,000

**The ANTC / Capital financial capacity assessment was determined with data from the MN Department of Revenue. This assessment takes into consideration both the tax base of a local government and the population.*

Technical Assistance

- Public Webinars
- Free consultation and support from the University of Minnesota Clean Energy Resource Teams (CERTS) on:
  - Building selection and energy usage
  - Utility interconnection
  - Selecting a developer through an RFP process
  - Cost-benefit analysis
  - Pre-application review for program application completeness
- Ongoing technical support through completion

Prioritization Rubric

- Rank your SPB Applications
- Pre-Application Consultation
- Procurement Commitment
- Financial Capacity
- Tie Breaker: Existing Solar

Timeline

The department will administer two funding rounds in 2024, with the potential for additional rounds:

- Round 1: April 2024 – October 2024: 2.15M
- **Round 2: October 2024 – April 2025: 2.15M**

Round 2: Public Building Readiness Assessment

Step 1: Notice of Intent: Public Building Readiness Assessment

- Date of Issue: Monday, October 21, 2024
- Public Building Readiness Assessment Due Monday, December 2, 2024
- Public Building Readiness Eligibility Notification: Monday, December 30, 2024

Round 1: Full Grant Application (Seeking Timeline Input)

Step 2: Full Grant Application

- Application Open: Upon Notification
- Application Due: Monday, March 24, 2025
- Final Notification: Monday, April 21, 2025

Prepare for Readiness Assessment

- Schedule a pre-application consultation
  - 11 County Metro: Aaron Backs abacks@gpisd.net
  - Outside of Metro: Pete Lindstrom plindstr@umn.edu

- Gather energy usage data:
  - Spreadsheet with last three years of energy use
  - Average annual energy use over last three years

- Estimate system size and production (https://pvwatts.nrel.gov/)
- Determine system budget
- Know your local government's procurement procedure and follow those processes to seek bids from developers

Questions/Input

Solar and the Publicly Owned Housing Program

Katherine Teiken | Climate Policy Director

MINNESOTA HOUSING

mnhousing.gov

Publicly Owned Housing Program

POHP can fund critical/physical needs to make a building ready for solar, including roofing and electrical.

We are exploring the ability to provide additional financial resources and technical assistance to include:

- Energy efficiency
- Renewable energy
- Electrification
- Climate Resiliency

Federal Solar for All Funds

Solar funds to support on-site residential and community solar for disadvantaged communities.

The Department of Commerce is the Lead Applicant and Minnesota Housing will be a sub-recipient:

- $10 million for multifamily deferred/forgivable loans
- $2 million for single-family home credit enhancements
  - Loan Loss Reserve and Interest Rate Buy Down

Timing: Anticipated in 2025

Solar 101 Key Takeaways

1. Solar offsets electric use, creates cash flow by reducing costs
    - Savings can be used for anything, including reducing resident housing/energy costs
2. Significant solar incentives exist and may be more than install cost
    - Tax-exempt organizations can access Direct Pay to monetize solar ITCs
3. Solar works really well with LIHTC and PBV properties
4. Roof replacement, or new construction is the ideal time for solar
5. Technical assistance is readily available (at no cost)
    - CERTs, H.S.A., University of Minnesota/Great Lakes TCTAC, HUD Renewable Energy Commitment and Technical Assistance

Get in Touch!

Are you interested in:

- *no-cost Technical Assistance to scope out and financially model solar on your building?*
- *no-cost Technical Assistance to identify and pursue other incentives for "greening" your buildings/portfolio?*

40 hours of Technical Assistance/organization is funded by MN Department of Commerce

Contact Housing Sustainability Advisors to get started!

rschlom@housingsustainability.com

jborchardt@housingsustainability.com

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