Overcoming Barriers to Solar Energy for Multi-family Buildings

A Case Study in Washington State

By Mason Rolph | Olympia Community Solar | January 2023

Olympia Community Solar

Executive Summary

Throughout Washington more than a million residents living in multifamily housing are prevented from realizing the benefits of solar energy due to a lack of an enabling solar law. The problem is becoming increasingly universal as population density increases in our urban areas and more market-rate dwelling units are under one roof.

This report presents a case study on installing solar energy on a multifamily housing project with meters for each housing unit. We'll explore the barriers to solar presented by multifamily buildings and Washington state's policy environment and how we overcame some of those barriers for the residents of Merritt Manor.

Key Findings

- The 2019 American Community Survey reported that more than one million Washingtonians, about 14% of our state population, live in apartments. [1] More than eighteen thousand new apartments were built in 2020. [2]
- Traditional net-metering (RCW 80.60) does not provide a low-cost solution for installing solar on multifamily buildings, nor a solution for Renters or families that face income barriers.
- Infrastructure upgrades to modify multifamily buildings for solar are expensive and could be unnecessary with enabling state policy.
- Solar energy provides an opportunity to reduce the energy burdens of families living in multifamily housing, renters, and low-income households.

Recognition

South Sound Solar President Kirk Haffner and grant writer Arielle Simmons.

Washington Department of Commerce Clean Energy Fund staff Forrest Watkins and Aaron Dumas.

Glenn Wells, Fourth Street Housing LLC

Homes First

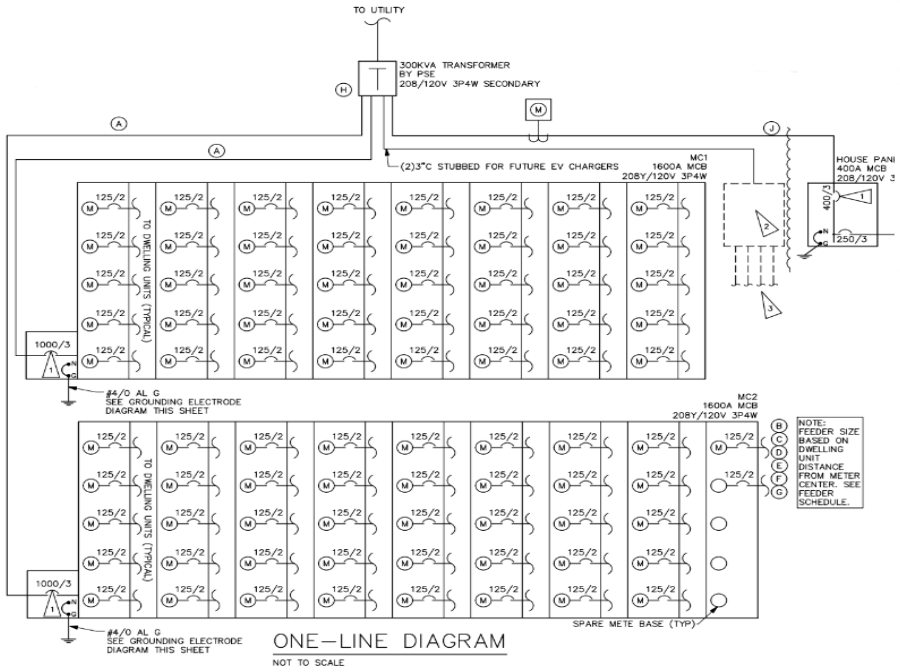
Prime Locations

Peer Reviewers: John Farrell from the Institute for local Self-Reliance, Raphaela Hsu-Flanders from the Bonneville Environmental Foundation, David Nicol from Forecast Solar, and Jeremy Smithson from Puget Sound Solar.

[1] 2019 American Community Survey, 1-Year Estimates, US Census Bureau. Updated 11/2020.
[2] Building Permits Survey, US Census Bureau. Updated 5/2021.

The Project Site

Merritt Manor is a four-story tall housing complex in Olympia Washington that hosts eighty-two income eligible apartments. There were two meter banks with eighty-two meters cumulatively, one meter for each apartment. The building's common area, elevators, and outdoor lighting are served by a separate house meter. The building's electric meter banks are pictured below.



Potential Solutions We Explored

Solar for the House Meter

A solar installation interconnected to the housing provider's electric meter (the "house meter") was feasible. The house meter is not in the meter bank and was available for net metering. Benefits of the solar generation would be realized by the housing provider.

We chose not to pursue this solution because our goal was to reduce the resident's energy burden. Using the house meter limits the project's scale and would not address the vast majority of the site's load.

Net-Metered Solar for the Residents

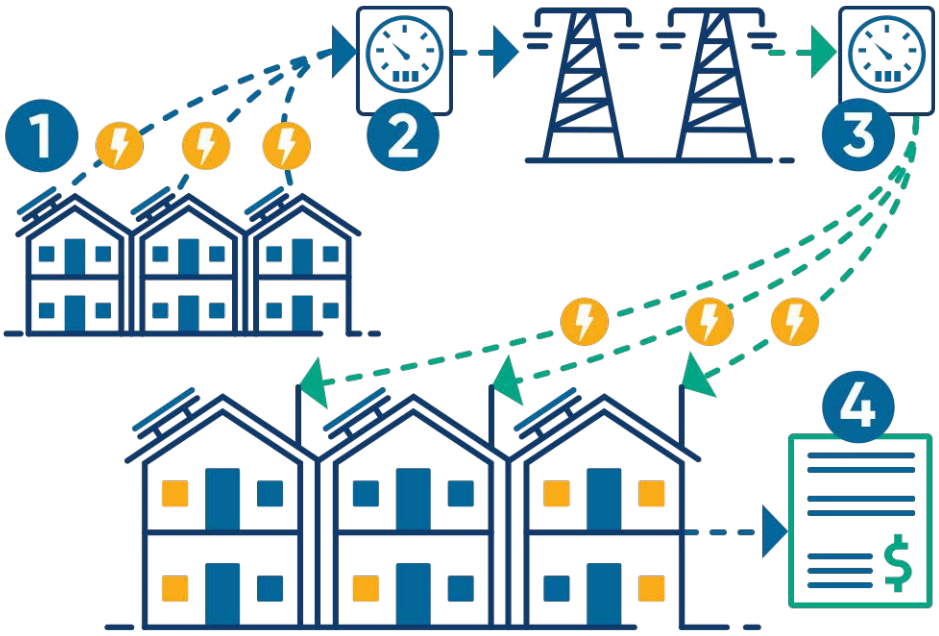
Traditional net metered solar allows for one solar installation connected to one electric account. Installing eighty-two separate solar installations on Merritt Manor was not feasible, and the meter banks prevented individual interconnections.

Virtually Net Metered Solar for Residents

Our preferred solution would be to interconnect directly to the utility grid with a production meter and administratively allocate the solar benefits to resident accounts. The electric utility would track solar production and provide bill crediting services to residents. This solution would prevent the need to replace or upgrade resident's electric meters.

Multifamily housing often lacks enough eligible roof area for solar to address the site's electric demand. Virtual net metering allows credits from a solar project located on a different property to reduce the energy burden of multifamily housing residents.

Due to refusal by the electric utility to provide bill crediting services, and lack of state policy, virtual net metering was not available to this project.



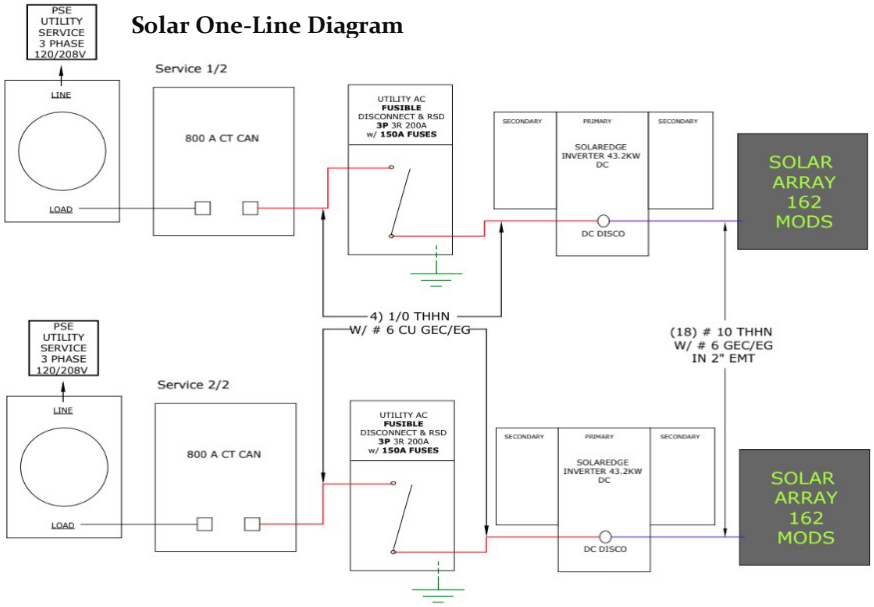
Multifamily Virtual Net Metering Graphic
Source: California Solar on Multifamily Affordable Housing (SOMAH) Program

Our Solution

In order to overcome the metering barriers described above, an electrical subcontractor upgraded the utility service to accommodate a single primary meter at each of the two points of service. The subcontractor removed the 82 individual residential meters and replaced them with bypass jumpers to deliver electricity to the apartments.

The Housing Provider has taken over the responsibility of paying Merritt Manor's electrical bills and uses an algorithm to charge each unit a utility fee based on the number of bedrooms in the apartment. This was only possible because the Housing Provider was willing to take over utility billing and our grant funding supported their system changes.

Solar One-Line Diagram



Resident Engagement

Olympia Community Solar invited Merritt Manor residents into the decision-making process and sought their informed consent to install solar with an interactive survey. Of the 82 housing units, 65 responded to our survey, representing 79% of the tenant population. 82% of respondents stated that electric costs represent a burden to their household. 100% of respondents affirmed that reducing pollution is important to them. 97% of respondents support the installation of solar, with the remaining 3%responding neutral but not opposed.

The survey findings indicate that A) a significant majority of respondents experience a financial burden from their energy expenses, B) respondents unanimously value the environmental benefits of the solar installation, and C) zero respondents oppose the installation of solar. Respondents also had the opportunity to submit questions and comments.

Respondents commented *"I think it would be a wonderful idea and make Merritt Manor somewhere I'm proud to call home!"* and *"It will be of great appreciation when those solar panels are installed, it helps a lot thank you for the concern it's (electricity costs) a big struggle to us"*.

Project Summary and Cost Benefit Analysis

The Merritt Manor solar project consists of 324 SunPower 390-watt modules (126.36 kW total) feeding two SolarEdge 43.2 kW inverters, SolarEdge P850 optimizers, and utilizes a roof mounting system. The project includes SolarEdge electricity monitoring, so the partners and residents can see in real-time how much the system is generating.

The project was funded by the Washington Department of Commerce's low-income solar deployment grant fund and installed by South Sound Solar[3].

The solar project was contracted at $2.34 per watt and the service upgrade added $0.36 per watt (13% of the total project cost). We estimate that the system will reach cost parity by operating year 14 and by year 25 will return 243% of the contract cost to residents. Thanks to the project's grant funding, zero percent of the project's cost was borne by residents.

Figure 1. Project Costs

Scope of Work	Cost Per Watt (DC)	Percentage of project
Equipment	$1.38	50%
Prevailing wage labor	$0.86	31.8%
Project Reporting / Grants	$0.05	2%
Solar Permitting	$0.05	2%
Meter Upgrade & Replacement	$0.31	11.5%
Electric Billing System	$0.04	1.4%
Meter Upgrade Permitting	$0.01	0.3%
Subtotal Metering Upgrade Cost	**$0.36**	**13.2%**
Total Project Cost	**$2.70**	**100%**

[3] South Sound Solar is a locally owned and operated solar installation firm founded in 2008. Their mission is to empower our local community through educational outreach and renewable energy. Through community outreach and customer service they strive to maximize the benefit of solar power on the environment and the economy. southsoundsolar.com

Figure 2. Basic Charge Savings.

	Single Tenant	Entire Building (82 residents)
First Month Savings	$6.86	$ 562.28
First Year Savings	$82.28	$ 6,747.36
Twenty-Five Year Savings[4]	$2,392.34	$ 196,171.96

Figure 3. Solar Generation Savings.

	Single Tenant	Entire Building (82 residents)
First Month Savings	$ 14.75	$ 1,209.29
First Year Savings	$ 170.04	$ 13,942.87
Twenty-Five Year Savings[5]	$ 7,444.75	$ 610,919.62

Figure 4. Estimated Tax Savings.

	Single Tenant	Entire Building (82 residents)
First Month Savings	$ 2.81	$ 229.97
First Year Savings	$ 32.75	$ 2,685.80
Twenty-Five Year Savings	$ 1,276.95	$ 104,768.56

The project's cumulative 25-year direct benefit is projected to save Merritt Manor approximately 1 Million dollars, or $12,378.67 per household. While we use the 25-year metric for these calculations, in the temperate climate of the Pacific Northwest solar modules can reliably produce energy for four decades or longer.

The residents see reductions in their utility rates in two ways. Individual apartments are no longer beholden to the $7.49/month basic charge ($614.18 cumulatively per month). The two new commercial meters each have a monthly basic charge of $25.95 ($51.90 total per month). The solar energy system generates 129 MWhs of electricity each year, reducing the resident's utility charges and associated taxes.

Another key outcome of this project is a significant reduction in regional pollution. According to our local utility's reported emissions and the EPA's Greenhouse Gas Equivalencies Calculator, the Merritt Manor solar project will reduce greenhouse gas pollution by 91.5 metric tons of carbon dioxide annually. The reduction is equivalent to 227,012 miles driven by a passenger

vehicle, or 100,805 pounds of unburnt coal.

[4] Benefit analysis assumes 2% annual compounding inflation.
[5] Benefit analysis assumes 2% annual compounding inflation, 5% annual compounding electric rate increases, and 0.6% annual solar module production depreciation.

FIGURE 4. TOTAL PROJECT SAVINGS

Operation Year	Estimated Solar Production (kWh)	kWh Value (5% inflation)	Solar Production Value	Basic Charge Net Savings (2% inflation)	Tax Savings (12.981%)	Total Annual Savings	Cumulative Savings
1	129,393	$ 0.12044	$ 15,584	$ 6,747	$ 2,898.78	$ 25,230	$ 25,230
2	128617	$ 0.12646	$ 16,265	$ 6,882	$ 3,004.70	$ 26,152	$ 51,381
3	127845	$ 0.13278	$ 16,975	$ 7,020	$ 3,114.83	$ 27,110	$ 78,491
4	127078	$ 0.13942	$ 17,717	$ 7,160	$ 3,229.35	$ 28,107	$ 106,598
5	126315	$ 0.14639	$ 18,491	$ 7,304	$ 3,348.44	$ 29,143	$ 135,742
6	125558	$ 0.15371	$ 19,299	$ 7,450	$ 3,472.30	$ 30,221	$ 165,963
7	124804	$ 0.16140	$ 20,143	$ 7,599	$ 3,601.12	$ 31,343	$ 197,306
8	124055	$ 0.16947	$ 21,023	$ 7,751	$ 3,735.11	$ 32,509	$ 229,815
9	123311	$ 0.17794	$ 21,942	$ 7,906	$ 3,874.49	$ 33,722	$ 263,536
10	122571	$ 0.18684	$ 22,901	$ 8,064	$ 4,019.49	$ 34,984	$ 298,520
11	121836	$ 0.19618	$ 23,901	$ 8,225	$ 4,170.33	$ 36,297	$ 334,817
12	121105	$ 0.20599	$ 24,946	$ 8,389	$ 4,327.27	$ 37,663	$ 372,480
13	120378	$ 0.21629	$ 26,036	$ 8,557	$ 4,490.56	$ 39,084	$ 411,564
14	119656	$ 0.22710	$ 27,174	$ 8,728	$ 4,660.47	$ 40,563	$ 452,126
15	118938	$ 0.23846	$ 28,361	$ 8,903	$ 4,837.28	$ 42,102	$ 494,228
16	118224	$ 0.25038	$ 29,601	$ 9,081	$ 5,021.28	$ 43,703	$ 537,931
17	117515	$ 0.26290	$ 30,894	$ 9,263	$ 5,212.77	$ 45,370	$ 583,301
18	116810	$ 0.27604	$ 32,244	$ 9,448	$ 5,412.08	$ 47,104	$ 630,405
19	116109	$ 0.28984	$ 33,653	$ 9,637	$ 5,619.52	$ 48,910	$ 679,315
20	115412	$ 0.30434	$ 35,124	$ 9,830	$ 5,835.44	$ 50,789	$ 730,104
21	114720	$ 0.31955	$ 36,659	$ 10,026	$ 6,060.21	$ 52,745	$ 782,850
22	114032	$ 0.33553	$ 38,261	$ 10,227	$ 6,294.20	$ 54,782	$ 837,632
23	113347	$ 0.35231	$ 39,933	$ 10,431	$ 6,537.79	$ 56,902	$ 894,534
24	112667	$ 0.36992	$ 41,678	$ 10,640	$ 6,791.40	$ 59,109	$ 953,643
25	111991	$ 0.38842	$ 43,499	$ 10,853	$ 7,055.45	$ 61,408	$ 1,015,051

About Olympia Community Solar

Olympia Community Solar is a nonprofit with the mission to steward an equitable and accessible clean energy transition. Through solar education, project development, and grant writing, Olympia Community Solar supports tribes, non-profits, and low-income housing residents to fund and install solar.

Our programs have resulted in more than two megawatts of new solar capacity in Western Washington and a new State sponsored low-income solar incentive program.

You can find more information online at olysol.org or on Facebook, Instagram, or LinkedIn by searching for Olympia Community Solar.

For questions, comments, or feedback on this case study please email info@olysol.org.

Appendix A: Electrical Service Upgrade Scope of Work

Convert (2) separate existing 1000-amp services with 82 meters total to (2) 800 amp CT services with (1) CT meter per service as listed below:

- Coordination of utility shutdowns for cut-over to new CT services.
- (2) Install new 800amp 3 phase CT cans, brackets, and utility rated meter sockets.
- (2) Intercept existing service conduits and conductors that feed existing 1000amp main breakers on the meter.
- Stack, provide and install new junction boxes below 1000 amp breakers, and re-route the existing feeders to the new CT can that will sit adjacent to the existing main breakers.
- (2) Provide and install 800amp conduits and new feeders/conductors from the new CT can to the existing 1000amp main breakers.
- (2) Convert the existing 1000amp trip units in the existing main breakers to 800amp trip units.
- (2) Provide and install new 3 phase 200amp raintight disconnects with 150amp fuses for connection of Solar backfeed by others.
- (82) Provide and install 1 phase meter socket jumper/bypass plates in place of the (82) Utility meters.
- (1) Electrical Permit and Inspections.

Related Research and Materials

Washington Department of Commerce: Solar Deployment Grant Program:

https://www.commerce.wa.gov/growing-the-economy/energy/clean-energy-fund/clean-energy-fund-solar-program/

California Solar on Multifamily Affordable Housing (SOMAH) Program

https://calsomah.org/

https://calsomah.org/resources/understanding-your-utility-bill-after-solar

San Francisco Department of the Environment "Virtual Net Energy Metering at Multi-tenant buildings"

https://sfenvironment.org/sites/default/files/fliers/files/virtual_net_energy_metering_at_multitenant_buildings_0.pdf

National Renewable Energy Laboratory "Community Solar Resources for Multfamily Affordable Housing Providers"

nrel.gov/docs/fy22osti/83870.pdf

Aurora Solar "How Virtual Net Metering Opens New Markets of Solar Customers"

https://aurorasolar.com/blog/how-virtual-net-metering-opens-new-markets-of-solar-customers/

Canary Media "Adding Solar to California Apartments could get easier - if regulators go along"

https://www.canarymedia.com/articles/solar/adding-solar-to-california-apartments-could-get-easier-if-regulators-go-along