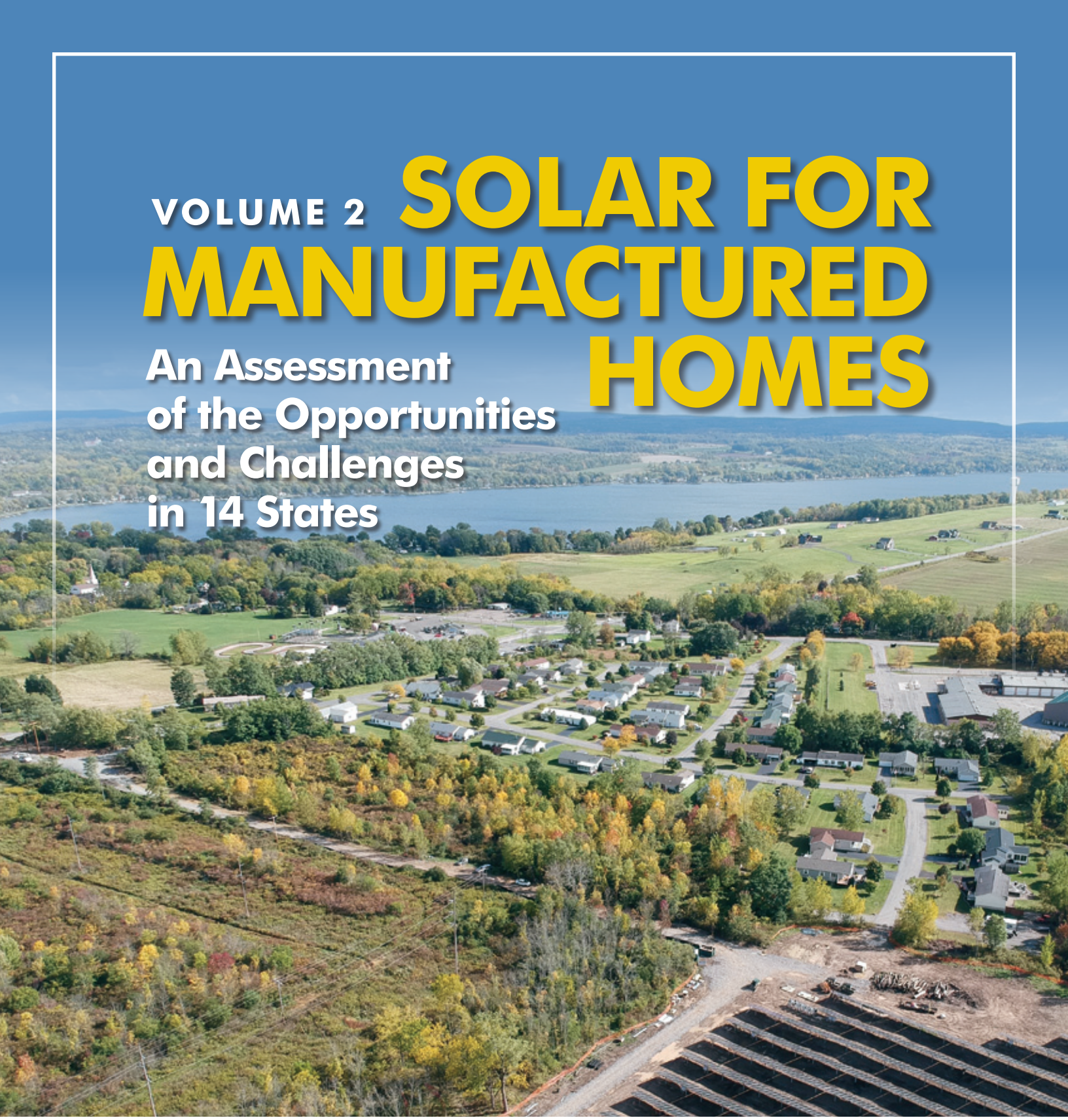
VOLUME 2

SOLAR FOR MANUFACTURED HOMES

An Assessment of the Opportunities and Challenges in 14 States



Clean Energy States Alliance

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APRIL 2021

ABOUT THIS REPORT

The Clean Energy States Alliance (CESA) produced this two-volume report as part of its Scaling Up Solar for Under-Resourced Communities project. This three-year project is a wide-ranging initiative to accelerate solar development that will benefit low- and moderate-income (LMI) households and communities. It focuses on three distinct subsets of the LMI solar market: single-family homes, multifamily affordable housing, and manufactured homes. The several authors prepared this report during their ongoing and former time as CESA staff members: Warren Leon, CESA Executive Director; Kat Burnham, former Research Associate; Nate Hausman, Project Director; and Laura Schieb, former Program Associate.

The Scaling Up Solar for Under-Resourced Communities project is supported by the US Department of Energy Office of Energy Efficiency and Renewable Energy (EERE) under the Solar Energy Technologies Office Award Number DE-EE-0008758. The Solar Energy Technologies Office supports early-stage research and development to improve the affordability, reliability, and domestic benefit of solar technologies on the grid. Learn more at energy.gov/solar-office.

With the release of this report, CESA will begin outreach to and work with state energy agencies and utilities to explore launching pilot projects to develop solar installations that benefit manufactured home residents. To find out more about this effort or to join a working group of government agencies and utilities interested in solar for manufactured homes, contact CESA Project Manager Wafa May Elamin at WafaMay@cleanegroup.org.

DISCLAIMER

Cover photo: Aiken Electric Cooperative

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Several CESA staff members, in addition to the report authors, contributed to the report. Wafa May Elamin and Georgena Terry wrote case studies; Charles Hua prepared the maps and helped with the data analysis; and Maria Blais Costello copyedited the report, and she managed production with David Gerratt of DG Communications, the report's designer.

Autumn Proudlove and Brian Lips of the North Caroline Clean Energy Technology Center analyzed the economics of indicative residential solar installations in the 14 target states. Their analysis appears in Appendix A. Darren Krolewski and John Mason of Datacomp shared data in their company's database of manufactured home communities and later reviewed a draft of the report for accuracy. Naim Darghouth of Lawrence Berkeley National Laboratory linked the communities in the Datacomp database to their census tracts and to their local electric utilities.

Although we cannot thank them all individually here, we very much appreciate the help we received from dozens of people who provided us with information during the research phase of this project.

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Any errors or omissions are the authors' alone. The document is not intended to provide legal or technical advice.

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INTRODUCTION TO VOLUME 2

This report is the second of two volumes for *Solar for Manufactured Homes: An Assessment of the Opportunities and Challenges in 14 States*, prepared by the Clean Energy States Alliance. It builds on the research and findings in Volume 1. That volume provides a national overview and describes the nature of the US manufactured housing stock, explains the general obstacles to solar for low- and moderate-income (LMI) manufactured homes, profiles the types of solar technologies and solar initiatives that can work with manufactured housing, and offers general recommendations that can guide future solar development in this market.

Volume 2 provides an assessment of the opportunities and challenges for developing solar for manufactured homes in each of 14 target states—Arizona, California, Florida, Georgia, Kentucky, Maine, Michigan, Missouri, New Mexico, North Carolina, Ohio, South Carolina, Texas, and Virginia.

Most of Volume 2 consists of state-focused chapters. Each chapter gives policymakers, utilities, solar industry representatives, manufactured homes associations, and other stakeholders a general sense of the landscape in the state and detailed data on its manufactured homes. Quantitative information in each chapter includes maps showing the geography of manufactured homes in the state and tables showing the number and types of manufactured home communities, including their income level and electric utilities. The discussion of each state covers relevant energy policies, the extent of the solar market, and typical costs of a PV system for a manufactured home. Each chapter features recommendations on the likely best opportunities for implementing solar for manufactured homes.

The state chapters rely heavily on information from the US Census Bureau, especially the 2019 American Community Survey (ACS). To go beyond the Census Bureau information, the project team secured the use of proprietary data on manufacture home communities collected by Datacomp, the nation's largest provider of value and appraisal reports on those communities. The team then linked Datacomp data on 24,391 residential communities in the 14 states to Census tract income data and utility service territories.

Volume 2 contains three appendices. Appendix A contains the full results of analysis by the North Carolina Clean Energy Technology Center of typical PV systems in the 14 states. Appendix B presents brief findings about 12 states that were initially target-state possibilities but that were not selected for detailed study. Because the team collected some information about those states, that information is shared here. Finally, Appendix C describes the methodology used for analyzing all this data.

Both volumes of this report are available on the Clean Energy States Alliance website at https://www.cesa.org/resource-library/resource/solar-for-manufactured-homes.

STATE-FOCUSED CHAPTERS

Arizona

THE STATE'S MANUFACTURED HOUSING STOCK

There are 314,042 manufactured homes in Arizona, according to the US Census Bureau's 2019 American Community Survey (ACS). They represent a significant share (11 percent) of the state's housing stock. The high percentage of these homes that are located in large, manufactured home communities, especially communities restricted to residents over 55 years in age, is especially notable.

The Datacomp database for Arizona includes 1,008 manufactured home communities and 147,379 homesites, which is 47 percent of the manufactured homes the US Census Bureau estimates for the state. Datacomp is missing site counts for 350 of the communities, so there could be more homesites, although it is also possible that some of the homesites are vacant or that communities have closed. Arizona is one of five target states with approximately half or more of the state's manufactured housing located within manufactured home communities.

Most of the communities (423) with site counts in the Datacomp database are large, with over 100 homesites. There are 57 communities with more than 500 homesites each. In total, there are 134,754 homesites in large communities, which totals more than 90 percent of the homesites in the database.

The large communities are predominantly age restricted for senior citizens. In total, there are 358 age-restricted communities with 104,926 sites, and most of those communities fall into the large category. There is a much higher concentration of age-restricted communities in Arizona than in any other state that was analyzed for this report. In Arizona, 35.5 percent of the communities in the Datacomp database have age restrictions. The next highest state among the 26 for which this project secured data is Florida with 20.7 percent of communities having age restrictions. Among the 26 states, only five states, including Arizona and Florida, have more than 20 percent of communities with age restrictions.

A very high percentage of the communities in the Datacomp database are in a census tract that is low-income or moderate-income compared to the median household income of both the core-based statistical area (CBSA) and the state median household income of $58,945. Nearly 90 percent of communities are in LMI census tracts when compared to the state

TABLE AZ1: **Arizona Communities and Sites in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
% of Sites	90.68%	70.57%	86.34%	58.11%
% of Total Communities	93.36%	79.88%	89.68%	67.21%

median household income. This finding that most communities of manufactured homeowners fall in low- and moderate-income (LMI) census tracts holds true across all community sizes, but this is especially true among large communities. Because most of the homesites in the database are in large communities, it means that a very high percentage of homesites are in LMI census tracts. See Table AZ1.

The percentage of communities and sites in LMI and low-income census tracts is higher in Arizona than in any of the other 14 target states, when measured in comparison to the CBSA median household income and the state's median household income. Because of the unusually large number communities age-restricted to older residents, there are almost certainly more retirees among manufactured housing residents in Arizona than in other states. Without household members in the workforce, many of the households in age-restricted communities may have quite low incomes, even if they have higher levels of wealth.

When viewed in the context of all new home construction in Arizona, the market for new manufactured homes has not been especially robust. In 2019, 2,402 manufactured homes were shipped to the state. In contrast, building permits were issued to 33,981 site-built, single-family homes.[1]

The majority of the manufactured home communities and sites are located in the service territories of two large utilities—Arizona Public Service, the state's largest investor-owned utility, and the Salt River Project in the Phoenix Metropolitan Area (a combined total of 710 communities). There are also 178 communities and 19,648 homesites in the service territory of investor-owned utility Tucson Electric Power in the southern part of the state. Among small utilities, there are notable concentrations of manufactured home communities in the territories of Electric District No. 2 (23 communities and 6,001 sites, all in LMI census tracts) and Hohokam Irrigation and Power in Pinal County (20 communities and 5253 sites, all in LMI census tracts), both in Pinal County.

THE STATE'S SOLAR LANDSCAPE

Arizona has been an active state for solar development. It ranks fifth among states in total solar capacity installed. According to the most recent data from the Solar Energy Industries Association, there are a combined 176,544 PV installations in the state, including residential, commercial, institutional, and utility-scale projects.[2] The state's solar resource is excellent

1 US Census Bureau, "U.S. Manufactured Housing Shipments by State: 2019," *https://www2.census.gov/programs-surveys/mhs/visualizations/2019/2019usmapbystate.pdf;* US Census Bureau, "Building Permits Survey Annual Data," *https://www.census.gov/construction/bps/stateannual.html.*

2 Solar Energy Industries Association, "Arizona Solar" webpage, accessed March 22, 2021, *https://www.seia.org/state-solar-policy/arizona-solar.*

(second best among US states), leading to strong production from installed systems. Relatively high electricity costs (15th highest in the nation) make solar generation potentially valuable.

In recent years, there has been turbulence in solar policies, creating uncertainty for solar installers and customer. In 2016, the state legislature ended net metering. Instead, utility companies can set their own renewable energy rates, charge additional fees for solar owners, reduce rates at which customers are compensated for electricity generated by their solar systems, and apply varied rate schedules and policies.

Economics of a Typical PV System. The cost analysis prepared for this project shows that a 4-kilowatt (kW) PV system would have produced positive cash flow under all the modeled scenarios. Only California yielded more positive financial results among the 14 target states assessed for this report. However, there is still the issue that the upfront cost of a system would discourage LMI households from pursuing solar, and there would be some significant financial risks for the households. Arizona allows third-party ownership of PV systems, which could help overcome those problems.

Nevertheless, a state agency or utility would need to design and implement a special solar program to provide solar for a significant number of LMI manufactured homes. The size of incentives and other financial support would not need to be as large as in other states.

Utility Programs and Perspectives. Arizona has 14 rural electric cooperatives and 31 municipal utilities. Some of them have shown interest in special initiatives for their LMI ratepayers. However, on-bill financing for solar is not currently available to assist customers. A representative of one cooperative expressed skepticism about extending solar to manufactured homes. He noted, "Solar systems on manufactured homes tend to be more complicated because it is against the building code to mount the solar systems on the roofs. Stand-alone carports and garages must have engineered roofs." In explaining why this utility does not and would not offer on-bill financing for solar for LMI members, he assumed solar would simply increase coop members' costs and it would not "be wise to add charges to bills that members already have difficulty paying."[3]

On the other hand, Trico Electric Cooperative has supported the Trico Community Sun Farm in Marana, Arizona, which allows members to purchase solar panels in a shared-solar array in quarter, half, or full panel increments, ensuring that members can select an option that works best for them. The billing works similarly to net metering for a residential rooftop solar system by reducing members' bills on a per-kilowatt-hour basis for every kilowatt-hour (kWh) generated by their share of the community solar array.[4] Although this rural electric cooperative, which serves 44,000 customers, has shown an interest in promoting solar, the Datacomp database reveals only four manufactured home communities with 437 homesites. Of course, there could be additional manufactured homes outside formal communities.

3 Email communication, June 3, 2020.

4 Nick Stumo-Langer, "Are Rural Electric Cooperatives Driving or Just Dabbling in Community Solar?", (Institute for Local Self-Reliance, March 2016), *https://ilsr.org/rural-electric-and-cooperatives-community-solar.* See the Trico Electric Cooperative webpage on "Energy Strategies" for additional information about its solar activities, *https://www.trico.coop/sustainable-energy/energy-strategy.*

Community solar has not been offered on a statewide basis, but there have been more geographically focused community solar initiatives in addition to Trico Electric's, sometimes providing a premium product that is more expensive than conventional electricity from the utility company (e.g., the Bright Arizona Community Solar Program from UniSource Energy[5]) and sometimes promising savings to subscribers.

Arizona Public Service (APS), the state's largest utility, runs a utility-owned, customer-sited, rooftop solar program for LMI customers. Under its Solar Communities Program, APS contracts 20-year rooftop solar leases with participating customers. The conditions of the agreement provide for the installation of a solar system on a participating customer's roof. APS owns the solar system and the electricity generated by it, and in exchange, APS provides a $30 monthly bill credit to the customer who is hosting the system. There are no upfront costs to participate in the program, but customers must own their own home, have a roof in good condition with suitable insulation, and meet income eligibility requirements. The program is not accepting application at this time; and because of concerns about the structural stability of manufactured homes' roofs and limited roof space, it is not clear that manufactured homeowners would be eligible. But, with expanded program eligibility and the advent of new technologies, this kind of program could illuminate a pathway for greater solar access for LMI manufactured homeowners in Arizona.[6]

Solar Industry Perspectives. Large solar projects were developed at two manufactured home communities. In 2013, 630 kilowatts of PV was installed at Far Horizons East, a retirement community with 416 homesites in East Tucson. The solar installations on several carports not only provide electricity, but also shading for cars and shuffleboard courts. The project is expected to offset about 46 percent of Far East Horizon's power usage.[7] There was a similar-sized project two years previous at the all-age Plaza Del Sol Mobile Home Resort in Tucson. Those projects were made possible by performance-based incentives from Tucson Electric Power.[8]

Three solar industry representatives who responded to this report's survey of installers have experience installing solar on manufactured homes, although they all understand that many manufactured homes are not structurally sound for rooftop installations. Sun Valley Solar Solutions CEO Russ Patzer reports that they take account of that issue by having a structural engineer inspect the roof before installing solar on it. Solar Solution AZ has found that they are able to install solar on most double-wide homes that were manufactured in the past few decades. Another Arizona solar provider, One Way Electric, has also had success installing solar on some manufactured homes.[9]

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5 UniSource Energy Services, "Bright Source Community Solar" webpage, accessed September 20, 2020, *https://www.uesaz.com/community-solar.*

6 Arizona Public Service, "Solar Communities Program" webpage, accessed September 20, 2020, *https://www.aps.com/en/About/Sustainability-and-Innovation/Technology-and-Innovation/Solar-Communities.*

7 "Big Solar Array Gives Mobile-Home Park Power, Shade," Arizona Daily Star, August 31, 2013, *https://tucson.com/business/local/big-solar-array-gives-mobile-home-park-power-shade/article_e17df1b1-b531-5eda-a532-eefd72516dcc.html.*

8 "Mobile Home Resort Now Has Solar Energy," Niche Investment's Network Blog, n.d., *https://nicheinvestmentnetwork.wordpress.com/2011/05/25/mobile-home-resort-now-has-solar-energy/amp.*

9 Responses to CESA solar installer survey, April 28, 2020.

RECOMMENDATIONS

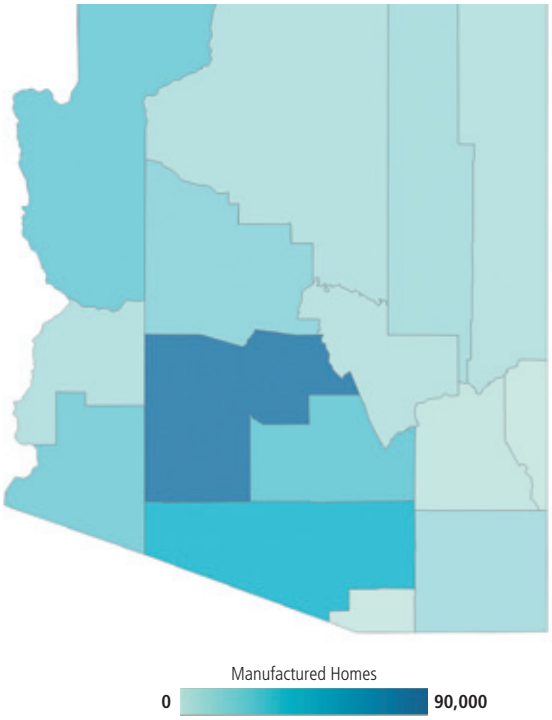
The large manufactured home communities in Arizona offer the most logical target for initiatives to enable solar for manufactured housing. There could be efficiencies by implementing marketing campaigns aimed at one or more large communities where there are community members' associations and mechanisms for disseminating news. A Solarize-style campaign could work well in such a setting—either seeking to offer a large number of identical ground- or pole-mounted systems or seeking subscribers to a shared community solar project.

To reach the residents of the many age-restricted communities would require special targeted education and outreach to overcome homeowners' possible hesitance to enter into a long-term investment in solar. Senior residents would need to understand that a solar lease is connected with the PV system installed on the house and not with them personally. They would need to be shown how they would benefit immediately from reduced electricity costs and that anyone who later purchased the house from them would also benefit.

Sales of manufactured homes are not a sufficiently large share of the new homes market in Arizona to justify making it a major focus. Yet there could be some modest efforts to influence the sellers and purchasers of the 2,400 manufactured home that are being shipped annually to the state.

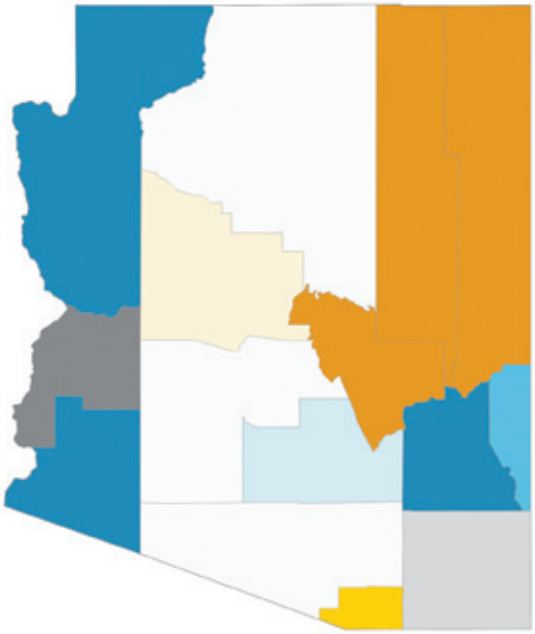
THE GEOGRAPHY OF ARIZONA'S MANUFACTURED HOMES

FIGURE AZ1: **Total Manufactured Homes**



This map shows the total number of manufactured homes per county, as estimated in the US Census Bureau 2019 American

FIGURE AZ2: **Manufactured Homes vs. Household Income**



	Manufactured Homes		
Income	Low	Medium	High
Low			
Medium			
High			

This map includes two variables for each county: the percentage of the housing stock that is manufactured homes and the median household income. This shows the correlation between manufactured homes housing stock and areas with low incomes.

TABLE AZ2: **Communities and Homesites by Utility**

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Ajo Improvement Co.	1	34	0
Arizona Public Service Co.	405	52,220	209
Buckeye Water C&D District	1	93	1
City of Mesa (AZ)	0	0	0
City of Safford (AZ)	0	0	0
Dixie-Escalante Rural Electric Assoc.	0	0	0
Duncan Valley Electricity Coop., Inc.	1	145	0
Electrical District No. 2 Pinal County	23	6,001	23
Hohokam Irrigtaion & Drain District	20	5,253	20
Mohave Electric Coop., Inc.	11	1,706	2
Navajo Tribal Utility Authority	7	492	1
Navopache Electric Coop., Inc.	17	1,031	1
Ocotillo Water Conservation District	1	1	1
Page Electric Utility	4	576	4
Roosevelt Irrigation District	10	317	9
Salt River Project	305	65,028	286
Sulphur Springs Valley Electric Coop., Inc.	20	1,119	15
Town of Thatcher (AZ)	0	0	0
Trico Electric Coop., Inc.	4	437	3
Tucson Electric Power Co.	178	19,648	154
UNS Electric, Inc.	27	2,652	9
USBIA–San Carlos Project	5	1,010	4
Wellton-Mohawk Irrigation & Drain District	3	203	0

DATA ABOUT ARIZONA'S MANUFACTURED HOME COMMUNITIES

Community Size

TABLE AZ3: **Number of Manufactured Home Communities by Size**

Category Range (sites in community)	Category Count	% of Total Communities with Site Counts
Large: >100	**423**	**64.29%**
>500	57	
300–499	85	
100–299	281	
Medium: 50–99	**131**	**19.91%**
75–99	60	
50–74	71	
Small: 1-49	**104**	**15.81%**
25–49	67	
1–24	37	
Communities without Site Counts	**350**	
Total Number of Communities	**1,008**	

TABLE AZ4: **Homesites by Community Size**

Community Size	Sites	% of Sites
Large	134,754	91.43%
Medium	9,622	6.53%
Small	3,003	2.04%
Total Sites	**147,379**	**100%**

Community Income

1. State Median Household Income — $58,945

TABLE AZ5: **Communities in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
Community Count	914	782	878	658
Site Count	133,639	104,012	127,244	85,646
% of Sites	90.68%	70.57%	86.34%	58.11%
% of Total Communities	93.36%	79.88%	89.68%	67.21%

TABLE AZ6: **Income by Community Size**

		Small	Medium	Large
LMI Communities (by CBSA)	Community Count	89	120	380
	Site Count	2,553	8,829	122,257
	% of Sites	85.58%	91.60%	89.83%
	% of Total Communities	13.53%	18.24%	57.75%
Low-Income Communities (by CBSA)	Community Count	77	107	310
	Site Count	2,174	7,841	93,997
	% of Sites	74.04%	81.68%	73.29%
	% of Total Communities	11.70%	16.26%	47.11%

2. Communities Restricted to Ages 55+

TABLE AZ7: **Total Number of Communities with Age Restrictions**

Number of Age-Restricted Communities	Sites	Percent of All Communities	Percent of All Sites
358	104,926	35.52%	71.19%

TABLE AZ8: **Age-Restricted Communities in LMI Census Tracts (by CBSA)**

	Small	Medium	Large
Total Number	**24**	**51**	**273**
LMI Communities	22	50	248
% of Age-Restricted Communities	6.15%	13.97%	69.27%
Low-income	**20**	**42**	**199**
% Age-Restricted Communities	5.59%	11.73%	72.91%

California

THE STATE'S MANUFACTURED HOUSING STOCK

Because California is such a populous state, it is unsurprising that the US Census Bureau reports many manufactured homes there—521,135. Yet this represents only 4 percent of the state's total housing stock. Most of those manufactured homes are in manufactured home communities, with most homesites in large communities and a significant number in age-restricted communities.

The Datacomp database for California includes 4,985 manufactured home communities, which is more than for any state other than Florida. The number of identified homesites (349,974) is also second to Florida. Those homesites represent 67 percent of the total sites in the US Census Bureau's count for California, one of only three target states with more than half the Census Bureau's homes accounted for in the Datacomp database. Given that Datacomp is missing site counts for 1,585 communities and may also be missing some communities, it is clear that an overwhelming majority of manufactured homes in the state are in manufactured home communities rather than on individually owned plots of land.

The California communities with site counts span a range of sizes, with a roughly equal number of small and large communities. Most homesites (75.9 percent) are in large communities with over 100 homesites. There are 37 communities with more than 500 homesites each. With 202 resident-owned communities (ROCs) and other nonprofit communities, California has more of these communities than any other state.

Many communities are restricted to residents older than 55. Among all identified communities, 17.7 percent have age restrictions, a percentage exceeded only by Arizona and Florida among the 14 target states. Because the age-restricted communities tend to be large, a significant portion of homesites (39.6 percent) fall within age-restricted communities.

Most communities in the Datacomp database are in a census tract that is low-income or moderate-income compared to the median household income of both the core-based statistical area (CBSA) and the state median household income of $75,235. Unsurprisingly in a state with a high median income and sharp discrepancies between income levels in different regions, many more of the census tracts are LMI or low-income when compared to the state median than to the CBSA (see Table CA1). This emphasizes that a disproportionate share of the communities is in parts of the state with below-average area incomes (see maps at the end of this section). A relatively similar share of age-restricted and non-age-restricted communities are in LMI census tracts.

TABLE CA1: **California Communities and Sites in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
% of Sites	66.21%	39.59%	74.42%	51.74%
% of Total Communities	65.00%	41.13%	82.44%	62.53%

Sales of new manufactured homes have been relatively weak in California in recent years. In 2019, 3,890 manufactured homes were shipped to market in the state. While that was the seventh largest number among all states, it was less than the number shipped to much smaller states, such as Alabama, Michigan, and South Carolina. In contrast, building permits were issued to 58,575 site-built, single-family homes.[1]

Manufactured home communities are distributed widely across the many utility service territories in California. Most are in the service territories of the three large investor-owned utilities: Pacific Gas & Electric (2,034 communities with 118,353 homesites), Southern California Edison (1,710 communities with 141,841 homesites), and San Diego Gas & Electric (405 communities with 36,525 homesites). However, California has five rural electric cooperatives[2] and 49 municipal utilities,[3] and many communities are located in some of their service territories, especially among smaller municipal utilities in rural areas. For example, Imperial Irrigation District has 114 communities with 8,497 sites, Modesto Irrigation District has 67 communities with 3,499 sites, and Turlock Irrigation District has 43 communities with 1,899 sites.

THE STATE'S SOLAR LANDSCAPE

California offers a very favorable environment for solar development. The solar resource is excellent in most parts of the state, electricity prices are high (7th highest among all states), and highly supportive solar policies are in place.

State Policies and Programs. California allows third-party ownership of residential PV systems. It also offers statewide community solar programs, but the two biggest programs, Green Tariff Shared Renewables Program and Enhanced Community Renewables Program, have not effectively served many LMI residents to date because they mostly require participants to pay a premium.

California has historically had a strong net metering policy. In 2016, the Public Utilities Commission (PUC), coming under pressure from utility companies, created a new net metering standard, which is referred to as NEM 2.0. This policy requires solar customers to sign up for time of use (TOU) electric plans in which electricity is charged at different rates based on the time of day. NEM 2.0 credits homeowners at a higher rate for energy sent to the grid at peak times and a lower rate during off-peak times. Each month, homeowners with solar are

1 US Census Bureau, "U.S. Manufactured Housing Shipments by State: 2019," *https://www2.census.gov/programs-surveys/mhs/visualizations/2019/2019usmapbystate.pdf*; US Census Bureau, "Building Permits Survey Annual Data," *https://www.census.gov/construction/bps/stateannual.html*.

2 National Rural Electric Cooperatives Association, Member Directory, *https://www.electric.coop/our-organization/nreca-member-directory*.

3 American Power Association, We are Community Powered, Find your Utility, Find your City, *https://wearecommunitypowered.com*.

charged a small fee (approximately $0.02 per kilowatt-hour (kWh)) called a "non-bypassable charge" for each solar kilowatt-hour sent to the grid, along with a minimum monthly fee that all customers must pay. At the end of the year, a final bill called a "true-up" is due; it tallies the total amount of energy the solar customer used minus the number of solar kilowatt-hours sent to the grid.[4]

California allows for Community Choice Aggregation (CCA), a program that enables local governments to pool their electrical load and to procure electricity for residents and businesses from an alternative supplier, sometimes at lower rates than standard retail electricity prices. By aggregating demand, local governments can procure electricity from renewable sources, such as solar, while continuing to receive transmission and distribution service from the investor-owned utility that serves the area. According to the California Community Choice Association, over 10,000,000 California customers are served by CCA providers, which collectively are responsible for 2,369 megawatts (MW) of new solar.[5]

California is a leader in offering programs that help low-income residents gain access to solar energy, with programs such as the California Solar Initiative Single-Family Affordable Solar Housing (SASH) Program and the Solar on Multifamily Affordable Housing (SOMAH) Program. The nonprofit GRID Alternatives administers the SASH program, which provides qualifying low-income homeowners with special upfront, capacity-based incentives (currently $3 per watt) to cover some of the upfront costs of a system. To be eligible, the homeowner must receive electrical service from one of the three large investor-owned utilities, have a household income no greater than 80 percent of area median income, and live in "affordable housing" as defined by California Public Utilities Code 2852.[6]

Under California's initiatives to help "disadvantaged communities," the Green-Tariff (DAC-GT) Program and the Community Solar Green Tariff (CSGT) Program hold promise for enabling manufactured homeowners in disadvantaged communities to subscribe to shared solar projects. Both programs are limited in scope but help participating customers to benefit financially by receiving 20 percent off their otherwise applicable electric rate.[7] The California Department of Community Services & Development also runs a community solar pilot program as part of its Low-Income Weatherization Program.[8]

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4 SolarReviews, "Everything you need to know about California Net Metering 2.0 in 2020," *https://www.solarreviews.com/blog/california-net-metering-nem-2 ; See also, California Public Utilities Commission, Net Energy Metering (NEM), https://www.cpuc.ca.gov/General.aspx?id=3800*.

5 CalCCA, "CCA Impact" webpage, accessed September 23, 2020, *https://cal-cca.org/cca-impact*.

6 California Public Utilities Commission, "CSI Single-Family Affordable Solar Homes (SASH) Program" webpage, https://www.cpuc.ca.gov/General.aspx?id=3043.

7 See SB 353 Disadvantaged Communities, accessed September 23, 2020, *https://oehha.maps.arcgis.com/apps/View/index.html?appid=c3e4e4e1d115468390cf61d9db83efc4*, and California Public Utilities Commission, "Solar in Disadvantaged Communities" webpage, accessed September 23, 2020, *https://www.cpuc.ca.gov/SolarInDACs/#CSGT*.

8 In 2018, California Department of Community Services & Development awarded over $2 million to GRID Alternatives to install a one MW solar system on tribal lands of the Santa Rosa Band of Cahuilla Indians—a project which will benefit over 38 low-income tribal member households and over 150 other low-income households in the area. GRID Alternatives, "First Low-Income Community Solar Project in California Underway," press release dated July 8, 2020, accessed September 24, 2020, *https://gridalternatives.org/sites/default/files/CSDSantaRosaCommSolarProject-pressrelease-FINAL.pdf*. California Department of Community Services & Development, "Community Solar Pilot Program" webpage, accessed September 24, 2020, *https://www.csd.ca.gov/Pages/Community-Solar-Pilot.aspx*.

Manufactured homes are left out of an important recent California solar initiative for new construction. As of January 2020, Title 24, the state energy code administered by the California Energy Commission, requires all new single-family homes and multifamily residences up to three stories tall to either have solar installed when they are built or to participate in "a community shared electric generation system."[9] However, this does not apply to manufactured homes because they are not covered under Title 24 enforced by the Energy Commission, but rather fall under the jurisdiction of Title 25, which covers HUD-code manufactured homes and is enforced by the California Housing and Community Development (HCD). New modular homes, in contrast, fall under Title 24 and are required to include solar.

California state agencies are giving attention to upgrading the quality and energy efficiency of manufactured housing in the state. The California Public Utilities Commission (CPUC) has been exploring ways to fully electrify homes in manufactured homes communities, while avoiding unreasonable rent increases, and various utilities have initiatives underway.[10] The California Energy Commission has proposed to make manufactured homes a focus of its EPIC program, which invests in research to transform the electricity sector. The EPIC 2021 investment plan lists Advanced Prefabricated Zero-Carbon Homes, including for manufactured housing, as the first of nine research initiatives.[11]

Economics of a Typical PV System. This project's analysis of the economics of a 4-kilowatt (kW) PV system did not consider the SASH incentives in its analysis. Even without those, California was the only one of the 14 target states that yielded positive financial results in all scenarios. When the SASH incentives are added in, the financial picture of solar for manufactured housing becomes even better.

Some solar installers have installed PV on manufactured homes in California, but they are first required to get a special permit from HCD to ensure that the installation does not cause roof damage or excessive weight load.[12] In some cases, manufactured home communities in California have successfully had solar installed on community common areas and carports, avoiding the HCD special permitting process.[13]

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9 California Energy Commission, "Building Energy Efficiency Standards—Title 24" webpage, *https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards*.

10 California Public Utilities Commission, *Stakeholder Workshop: Building Decarbonization Phase II Staff Proposal and Mobilehome Park Electrification and Tenant Protection Topics,* September 15, 2020, *https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Safety/Mobile_Home_Parks/BD%20Phase%20II%20and%20MHP%20Workshop_09152020_FINAL.pdf*. California is a promising location for solar for manufactured housing. As long as SASH

11 California Energy Commission, DRAFT Proposed EPIC Interim Investment Plan 2021, January 4, 2021, p. A-13, *https://www.energy.ca.gov/event/workshop/2021-01/rescheduled-staff-workshop-electric-program-investment-charge-interim*.

12 California Housing and Community Development, "Advisory for Manufactured Home Roof Mounted Solar Photovoltaic Systems," n.d., *https://www.hcd.ca.gov/manufactured-mobile-home/consumer-information/docs/solarpvadvisory.pdf.*

13 See Huntington Shorecliffs, CleanFund, "SolarPACE," accessed September 23, 2020, *https://www.cleanfund.com/news-and-events/news/solarpace-is-key-to-growth-for-the-commercial-solar-industry.* See also Dividend Finance, "Dividend Finance Closes Two $1MM+ Commercial PACE Bonds," November 17, 2017, accessed September 24, 2020, *https://www.dividendsolar.com/component/content/article?id=249:dividend-finance-closes-two-1mm-commercial-pace-bonds.*

Utility Programs. Some municipal utilities, most notably the Sacramento Municipal Utility District, have had active solar programs and at least two rural electric coops have promoted solar. Anza Electric Cooperative, which serves 3,900 members in Riverside County in southern California, established a community solar array in 2016 which assigned allocations on a first-come, first-served basis.[14] Plumas-Sierra Rural Electric Cooperative, with 6,600 members in northeastern California, offers a Community Solar Program with blocks of 100 kilowatt-hours per month available for members.[15] There are few manufactured homes in the Datacomp database in Anza territory, but 41 communities with 431 homes in Plumas-Sierra territory.

RECOMMENDATIONS

California is a promising location for solar for manufactured housing. As long as SASH incentives can be applied to manufactured housing, significant additional financial incentives are not needed to make progress in reaching this market. What is needed most is focused outreach, education, and marketing campaigns, combined with some modest special financial support to reduce risks for LMI homeowners and solar installation companies.

In general, the focus in California should be on manufactured housing in communities, rather than on individual plots of land, since manufactured home communities are so prevalent. Some of the 202 ROCs in California would be especially good targets for solar marketing campaigns, because the residents own the land and have the ability to make decisions about community-wide PV installations. There could be outreach to each community's homeowners' association. For a shared community solar project or an installation aimed at serving common loads, such as streetlights and recreational facilities, the association could handle securing approval from residents as necessary. Alternatively, a Solarize-style campaign to residents of ROCs could work well, if it promoted the installation of a large number of identical rooftop, ground-mounted, or pole-mounted systems.

The many other large communities would also be good targets. To reach the residents of the many age-restricted communities would require special targeted education and outreach to overcome homeowners' possible hesitance to enter into a long-term investment in solar. Senior residents would need to understand that a solar lease is for the solar PV system installed on the house and not with them personally. They would need to be shown how they would benefit immediately from reduced electricity costs, and that anyone who later purchased the house from them would also benefit.

Some additional analysis, perhaps developed by the California Energy Commission, HCD, the California CPUC,or a different state agency or organization, could determine what additional financial support would be necessary to significantly expand installations for manufactured housing. The same organizations might also provide additional information to solar installers to interest them in the LMI solar market. Specific utilities with significant numbers of manufactured home communities should also be encouraged to develop LMI solar programs for their customers.

14 Anza Electric Cooperative, http://*www.anzaelectric.org*.

15 Plumas-Sierra Rural Electric Cooperative, *https://www.psrec.coop*.

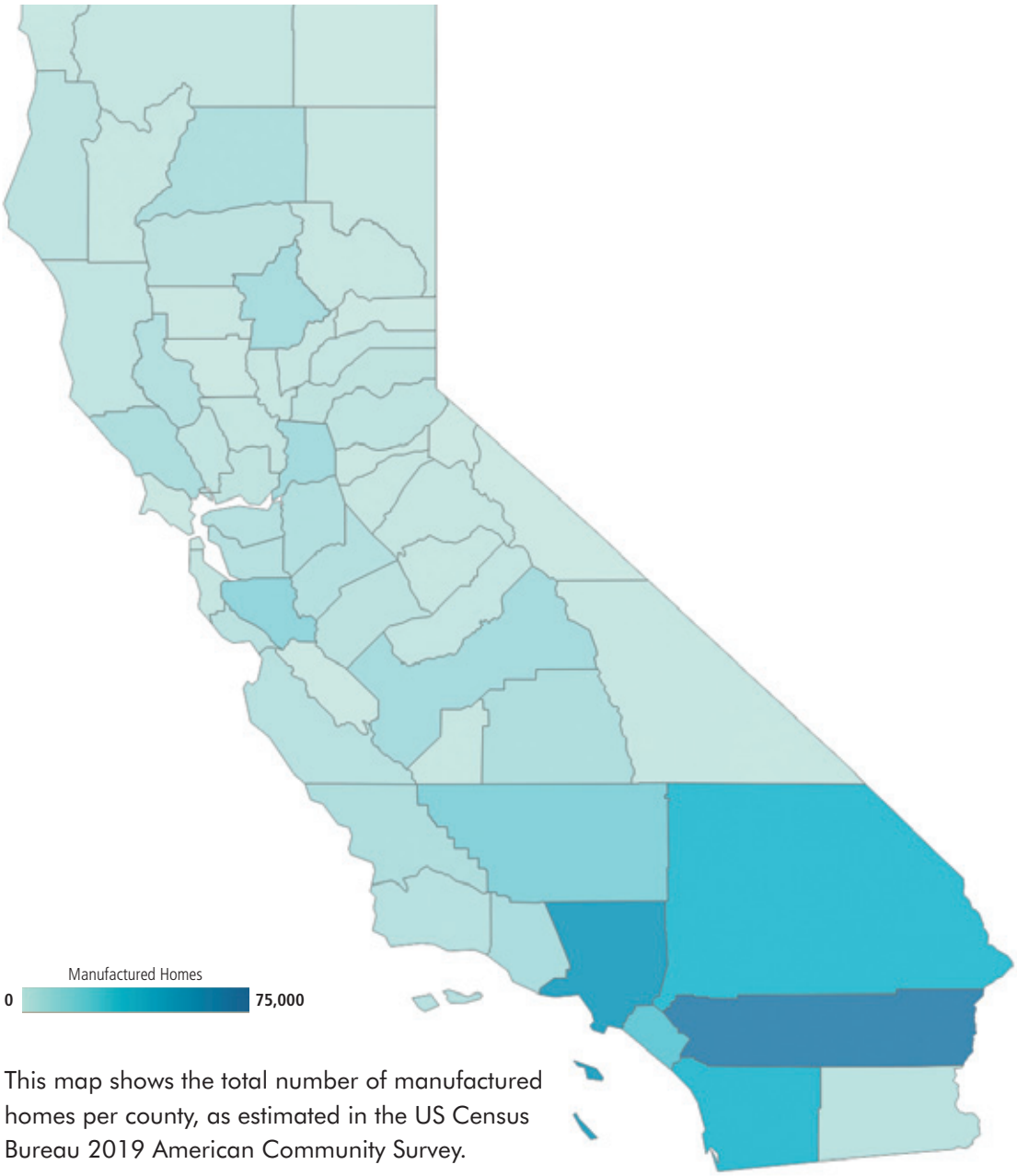
Although sales of new manufactured homes have been only a small share of the total new home market, it would still be desirable to undertake efforts to provide solar information to the sellers and purchasers of the 3,890 manufactured homes that are being shipped annually to the state. It could provide savings to include the price of a PV system in the mortgage or loan financing for new manufactured homes. Looking forward, it would be desirable to move towards a similar requirement solar for new manufactured homes as there is already for site-built housing. The California Energy Commission's proposed EPIC research project on Advanced Prefabricated Zero-Carbon Homes could be an important step in that direction.

In addition, some manufactured housing manufacturers are already prepared to provide solar-ready housing for the California market, and they should be encouraged to do that. For example, J. Gavin Mabe, Director of Engineering and Technology for Clayton Home Building Group, told researchers for this project that his company has models that are structurally able to support solar, and their facilities in California produce more of those models than their facilities in other states. Mabe indicated that a solar-compatible home, with a disconnect for an inverter and either a truss with additional capacity or adding blocking to a standard truss to support the weight of solar panels, would add approximately $500–$1,000 to the cost of a new home.[16]

16 J. Gavin Mabe, email correspondence, December 30, 2019.

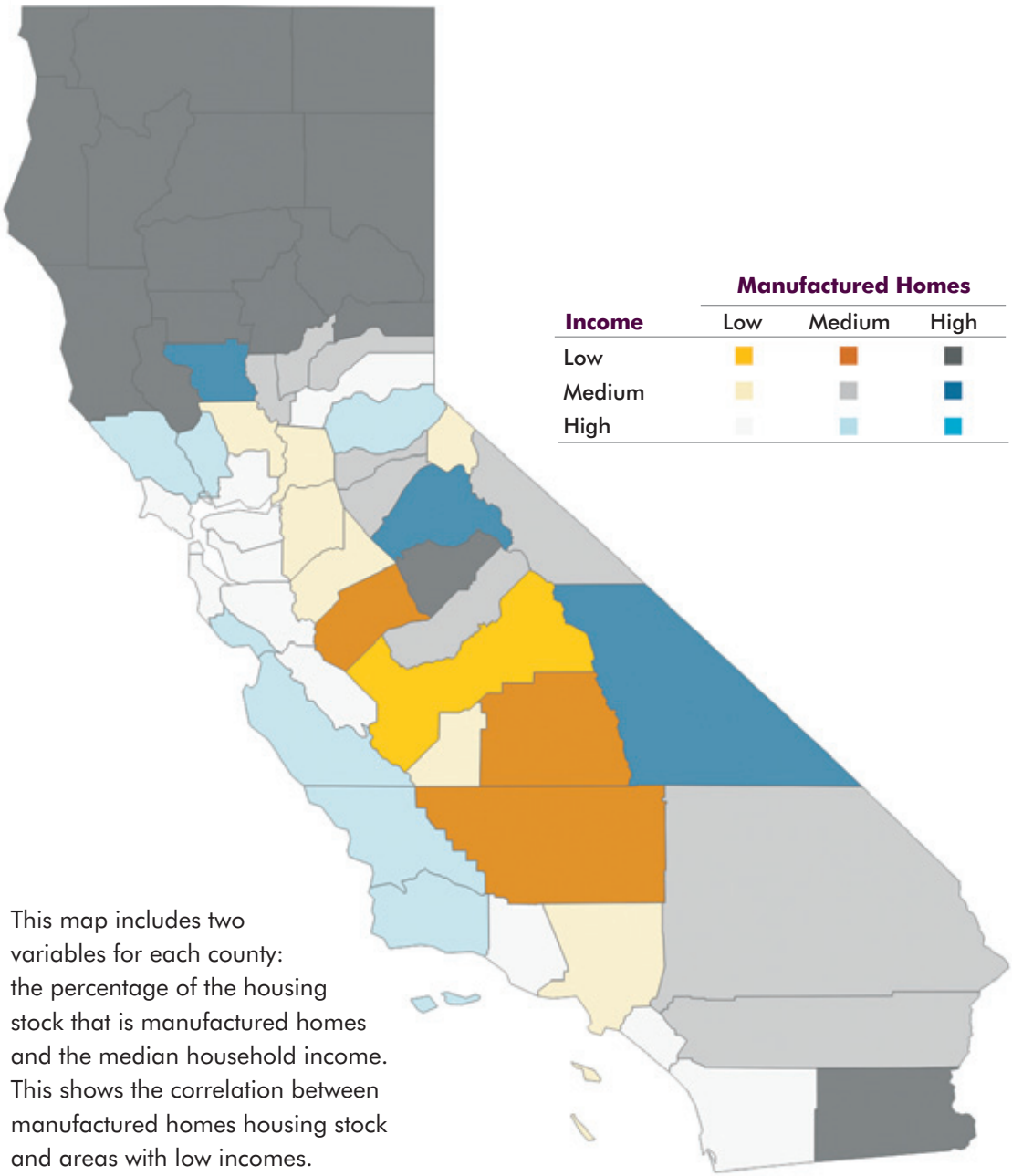
THE GEOGRAPHY OF CALIFORNIA'S MANUFACTURED HOMES

FIGURE CA1: **Total Manufactured Homes**



This map shows the total number of manufactured homes per county, as estimated in the US Census Bureau 2019 American Community Survey.

FIGURE CA2: **Manufactured Homes vs. Household Income**



This map includes two variables for each county: the percentage of the housing stock that is manufactured homes and the median household income. This shows the correlation between manufactured homes housing stock and areas with low incomes.

TABLE CA2: **Communities and Homesite by Utility**

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Anza Electric Coop., Inc.	5	5	5
Arizona Public Service Co.	3	558	1
City & County of San Francisco (Utility Co.)	1	1	1
City of Anaheim, California (Utility Co.)	27	3,291	21
City of Azusa, California (Utility Co.)	8	578	4
City of Banning, California (Utility Co.)	5	367	4
City of Biggs, California (Utility Co.)	1	2	0
City of Colton, California (Utility Co.)	7	933	6
City of Corona, California (Utility Co.)	11	753	8
City of Lodi, California (Utility Co.)	4	68	3
City of Lompoc, California (Utility Co.)	6	522	5
City of Moreno Valley,, California (Utility Co.)	1	107	0
City of Needles, California (Utility Co.)	13	767	13
City of Palo Alto, California (Utility Co.)	1	1	0
City of Riverside, California (Utility Co.)	14	2,018	8
City of Shasta Lake, California (Utility Co.)	4	243	3
City of Ukiah, California (Utility Co.)	4	151	4
Delmarva Power	1	27	0
Imperial Irrigation District	114	8,497	88
Lassen Municipal Utility District	19	1305	11
Los Angeles Department of Water & Power	102	7,546	38
Merced Irrigation District	21	1,648	11
Modesto Irrigation District	67	3,499	35
Pacific Gas & Electric Co.	2,034	118,353	1,171
PacifiCorp	97	1555	24
Plumas-Sierra Rural Electric Coop.	41	431	2
Rancho Cucamonga Municipal Utility	8	1,360	1
Sacramento Municipal Utility District	114	11,424	97
San Diego Gas & Electric Co.	405	36,525	257
Sierra Pacific Power Co.	30	651	16
Southern California Edison Co.	1,710	141,841	1,205
Surprise Valley Electrification Corp.	6	18	0
Trinity Public Utilities District	37	164	0
Truckee Donner Public Utility District	7	346	0
Turlock Irrigation District	43	1,899	23

DATA ABOUT CALIFORNIA'S MANUFACTURED HOME COMMUNITIES

Community Size

TABLE CA3: **Number of Manufactured Home Communities by Size**

Category Range (sites in community)	Category Count	% of Total Communities with Site Counts
Large: >100	**1,309**	**39.50%**
>500	37	
300–499	136	
100–299	1,136	
Medium: 50–99	**686**	**20.18%**
75–99	316	
50–74	370	
Small: 1–49	**1,405**	**41.32%**
25–49	643	
1–24	762	
Communities without Site Counts	**1,585**	
Total Number of Communities	**4,985**	

TABLE CA4: **Homesites by Community Size**

Community Size	Sites	% of Sites
Large	265,779	75.94%
Medium	50,159	14.33%
Small	34,036	9.73%
Total Sites	**349,974**	**100%**

Community Income

1. State Median Household Income — $75,235

TABLE CA5: **Communities in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
Community Count	3,161	2,000	4,009	3,041
Site Count	231,724	138,545	260,468	181,064
% of Sites	66.21%	39.59%	74.42%	51.74%
% of Total Communities	65.00%	41.13%	82.44%	62.53%

TABLE CA6: **Income by Community Size**

		Small	Medium	Large
LMI Communities (by CBSA)	Community Count	846	465	866
	Site Count	20,875	33,797	177,052
	% of Sites	60.21%	67.78%	66.16%
	% of Total Communities	24.88%	13.68%	25.47%
Low-Income Communities (by CBSA)	Community Count	538	284	515
	Site Count	13,119	20,429	104,997
	% of Sites	38.29%	41.40%	39.34%
	% of Total Communities	15.82%	8.35%	15.15%

2. Communities Restricted to Ages 55+

TABLE CA7: **Total Number of Communities with Age Restrictions**

Number of Age-Restricted Communities	Sites	Percent of All Communities	Percent of All Sites
883	138,538	17.71%	39.59%

TABLE CA8: **Age-Restricted Communities in LMI Census Tracts (by CBSA)**

	Small	Medium	Large
Total Number	**77**	**194**	**582**
LMI Communities	44	131	392
% of Age-Restricted Communities	4.98%	14.84%	44.39%
Low-income	**16**	**70**	**227**
% Age-Restricted Communities	1.81%	7.93%	25.71%

Florida

THE STATE'S MANUFACTURED HOUSING STOCK

Florida has more manufactured homes (840,074) than any other state according to the US Census Bureau. Nine percent of the state's housing stock is manufactured housing. Florida also has a larger number of manufactured home communities (5,101) than any other state, according to the Datacomp database. With so many communities, there are many of all types, but most homesites are located in large communities and in those that are age-restricted to residents over 55 years old.

The number of homesites in the Datacomp database (390,121) is more than for any other state. Those homesites represent 46.6 percent of the sites in the US Census Bureau's count, but Datacomp is missing site counts for 2,744 communities, slightly more than half of all of them. There are likely more homesites in communities than are listed in the Datacomp database, although it is also likely that some of the homesites are vacant and some communities have closed.

The Florida communities with site counts span a range of sizes, with a roughly equal number of small and large communities. But because the large communities, by definition, have more homesites, the overwhelming number of identified homesites (89.6 percent) are in large communities with over 100 homesites. Very large communities with more than 500 homesites are much more common (169) in Florida than elsewhere. With 183 resident-owned communities (ROCs) and other nonprofit communities, that arrangement is much more frequent than is typical.

Among all identified communities, 20.7 percent have age restrictions, a percentage exceeded only by Arizona. Because the age-restricted communities include many of the largest communities, 66.2 percent of identified homesites are in age-restricted communities.

A high percentage of the communities in the Datacomp database are in a census tract that is low-income or moderate-income compared to the median household income of both the core-based statistical area (CBSA) and the state median household income of $55,660 (see Table FL1). A slightly lower share of age-restricted communities is in LMI census tracts than among non-restricted communities.

There has been an active market for new manufactured homes in recent years, with 7,819 shipped to market in the state in 2019. However, this remains a relatively small share of all

TABLE FL1: **Florida Communities and Sites in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
% of Sites	74.22%	46.96%	82.40%	57.49%
% of Total Communities	71.14%	43.45%	82.75%	59.70%

new homes as 99,831 building permits were issued in 2019 for site-built, single-family homes. This number is only exceeded by Texas.[1]

Most of the manufactured home communities and more than 70 percent of the homesites are in the service territories of two large investor-owned utilities, Florida Power & Light and Duke Energy Florida. Because there are so many manufactured homes in the state, there are many other utilities with significant clusters. Two municipal utilities and eight rural electric coops have more than 1,000 identified homesites each, with Withlacoochee River Electric Coop in central Florida having 119 communities and 13,118 homesites.

THE STATE'S SOLAR LANDSCAPE

The pace of solar installations has increased considerably in recent years, although Florida still does not have as many PV projects as its nickname, the Sunshine State, might suggest. Florida's electricity prices fall in the middle of the pack in relationship to other states.

State Policies. Certain policies facilitate solar development, but incentives are not as gen-erous as in some other states. Florida's Public Service Commission set specific standards for net metering back in 2008. Those rules apply to the state's investor-owned utilities, and a solar customer's surplus energy is carried forward as a bill credit at the full retail rate to the following monthly bill for up to 12 months as a result. At the end of a 12-month billing period, the utility pays the customer for any remaining net excess generation at an avoided-cost rate. Rural electric cooperatives and municipal utilities are required to offer net metering, but they can set their own bill credit rates.

In 2018, solar installers won the right to offer solar leases to homeowners, but regulators stopped short of allowing solar companies to own the panels and sell the power to customers.[2] There are currently no solar programs targeted specifically at low-income customers.

Economics of a Typical PV System. The cost analysis undertaken for this project for a 4-kW system suggests that the economics of PV in Florida are more favorable than in some states, but significant new financial incentives would be necessary to help LMI homeowners pay for the upfront costs, or companies would need to be recruited to offer third-party-owned systems at favorable prices.

1 US Census Bureau, "U.S. Manufactured Housing Shipments by State: 2019," *https://www2.census.gov/programs-surveys/mhs/visualizations/2019/2019usmapbystate.pdf*; US Census Bureau, "Building Permits Survey Annual Data," *https://www.census.gov/construction/bps/stateannual.html*.

2 Solar.com, "Solar Policy Update—The Latest Home Solar Laws in Florida," June 1, 2018, *https://www.solar.com/learn/solar-policy-update-the-latest-home-solar-laws-in-florida*.

Utility Programs and Perspectives. Duke Energy Florida recently won approval for and established a program to develop 750 megawatts (MW) of solar under the "Clean Energy Connection" banner. Customers will be able to purchase one-kilowatt (kW) blocks of solar generation at a fixed monthly rate in exchange for credits on participating customer's electricity bills. The program will set aside 26 megawatts of solar for low-income customers, who will see guaranteed savings on their monthly electricity bills. Enrollment will begin in December 2021.[3] Various other utilities and government entities, such as Broward County, have offered a range of solar programs. There have been interesting initiatives by some of Florida's 16 rural electric cooperatives[4] and 33 municipal utilities.[5]

The Florida Electric Cooperatives Association is a network of electric cooperatives that serves approximately 10 percent of the state's residents and covers more than 60 percent of the land.[6] Some of the coops have offered subscriptions in community solar arrays as a way for members to participate in a solar project. A typical community solar program offers members one-kilowatt blocks of solar-generated power for a fixed monthly cost, but members are told that participation will not reduce their monthly electric bill.

For example, Choctawhatchee Electric Cooperative, serving western Florida, built a 494-panel 120-kW solar array on the roof of its operations center. Members who subscribe purchase a share of the energy generated from the array for a monthly flat fee. Members may be put on a waiting list to subscribe to a block of solar energy for either a one-year or five-year contract.[7] Another coop, Okefenoke Rural Electric Membership Corporation, serving north central Florida, has two 100-kW community solar arrays, and a 1.86-MW project. Members can purchase one or two blocks, each block being equivalent to the energy produced by a one-kilowatt portion of the solar array. The kilowatt-hours produced by each block are deducted from the total kilowatt-hours a member uses each month. If the block produces more kilowatt hours than used during a billing cycle, the member receives wholesale credit for any unused energy.[8]

Other Perspectives and Activities. The Solar and Energy Loan Fund (SELF), a nonprofit community development financial institution based in Florida, has financed more than $10 million of energy upgrades, closing over 1,000 loans to Florida households. SELF offers unsecured loans for PV systems for homeowners with no minimum credit score or minimum asset or home equity required.[9] Over 70 percent of its loans have served LMI homeowners. SELF has partnered with crowd-funding platform Kiva to support low-cost lending for energy improvements for women and military veteran homeowners. Under the partnership, Kiva will post a SELF project description on its platform for 30 days, enabling microlenders from around the world to support it.[10]

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3 Duke Energy, "Clean Energy Connection" webpage, accessed March 22, 2021. See also PV Magazine, "Duke Energy Florida Files for a New Customer Purchase Program, Hesitates to Call It Community Solar," July 2, 2020, *https://pv-magazine-usa.com/2020/07/02/duke-energy-florida-files-for-a-new-customer-purchase-program-hesitates-to-call-it-community-solar.*

4 National Rural Electric Cooperatives Association, Member Directory, *https://www.electric.coop/our-organization/nreca-member-directory.*

5 American Power Association, We are Community Powered, Find your Utility, Find your City, *https://wearecommunitypowered.com*.

6 Florida Electric Cooperatives Association, Inc., *https://feca.com*.

7 CHELCO—Choctawhatchee Electric Cooperative, *https://www.chelco.com/renewables*.

8 Okefenoke Rural Electric Membership Corporation, *https://oremc.com/csp*.

9 SELF, "Yahoo Finance: SELF Finances $10 Million in Sustainable Home Improvement Loans in Florida," accessed September 24, 2020.

10 SELF, "Women and Veterans" webpage, accessed September 24, 2020, *https://solarenergyloanfund.org/loan/kiva*.

The feedback researchers received from solar installers in Florida highlighted some of the barriers to projects for manufactured homes. They emphasized the need to identify funding sources to help LMI households afford systems and the unfamiliarity of most LMI households with solar.

RECOMMENDATIONS

Duke's "Clean Energy Connection" program could enable LMI manufactured homeowners in Florida to participate in the solar economy on a cash-flow positive basis. It could be a meaningful opportunity for LMI manufactured homeowners to benefit from solar without installing an array onsite. Both the utility and other stakeholders should be encouraged to target manufactured home residents for participation in the program.

The significantly number of large manufactured home communities in Florida represents a logical target of opportunity for initiatives aimed at manufactured housing. There could be efficiencies by implementing marketing campaigns aimed at one or more large communities where there are community members' associations and mechanisms for disseminating information. A Solarize-style campaign could work well in such a setting—either seeking to offer a large number of identical rooftop, ground-mounted, or pole-mounted systems or seeking subscribers to a shared community solar project.

The 183 resident-owned communities (ROCs) and other nonprofit communities deserve special attention because it is easier to ensure that benefits from a community-wide PV installation flow to the residents of ROCs. There could be outreach to each community's homeowners association. For a shared community solar project or an installation aimed at serving common loads, such as streetlights and recreational facilities, the association could handle securing approval from residents, as necessary. Alternatively, there could be a Solarize-style campaign to recruit customers for installations at individual houses.

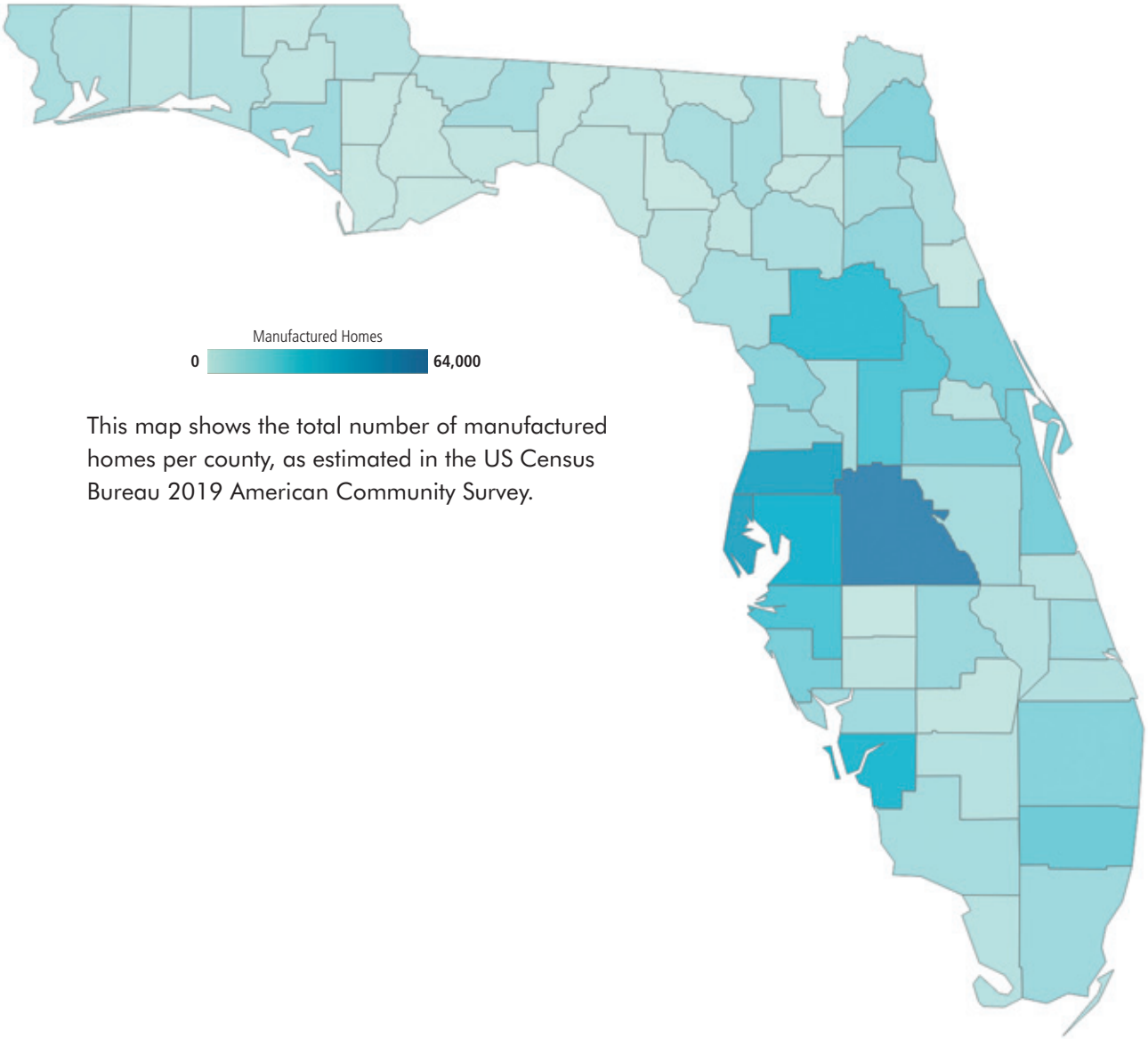
With so many of the communities being age-restricted, government agencies and solar marketers seeking to develop projects for manufactured housing would need to undertake special targeted education and outreach to overcome homeowners' possible hesitance to enter into a long-term investment in solar. Senior residents would need to understand that a solar lease runs with the house and not with them personally. They would need to be shown how they would benefit immediately from reduced electricity costs and that anyone who later purchased the house from them would also benefit.

Because some of the state's municipal utilities and rural electric coops have been experimenting with solar programs, especially community solar, it may be possible to encourage them to support solar for manufactured home communities as a way to alleviate poverty and reduce delinquent bill payments.

The market for new manufactured homes is sufficiently robust, so it would be desirable to undertake efforts to ensure that house purchasers have an option to buy a solar-ready manufactured home and to purchase a rooftop system that can be included as part of the financing on the home.

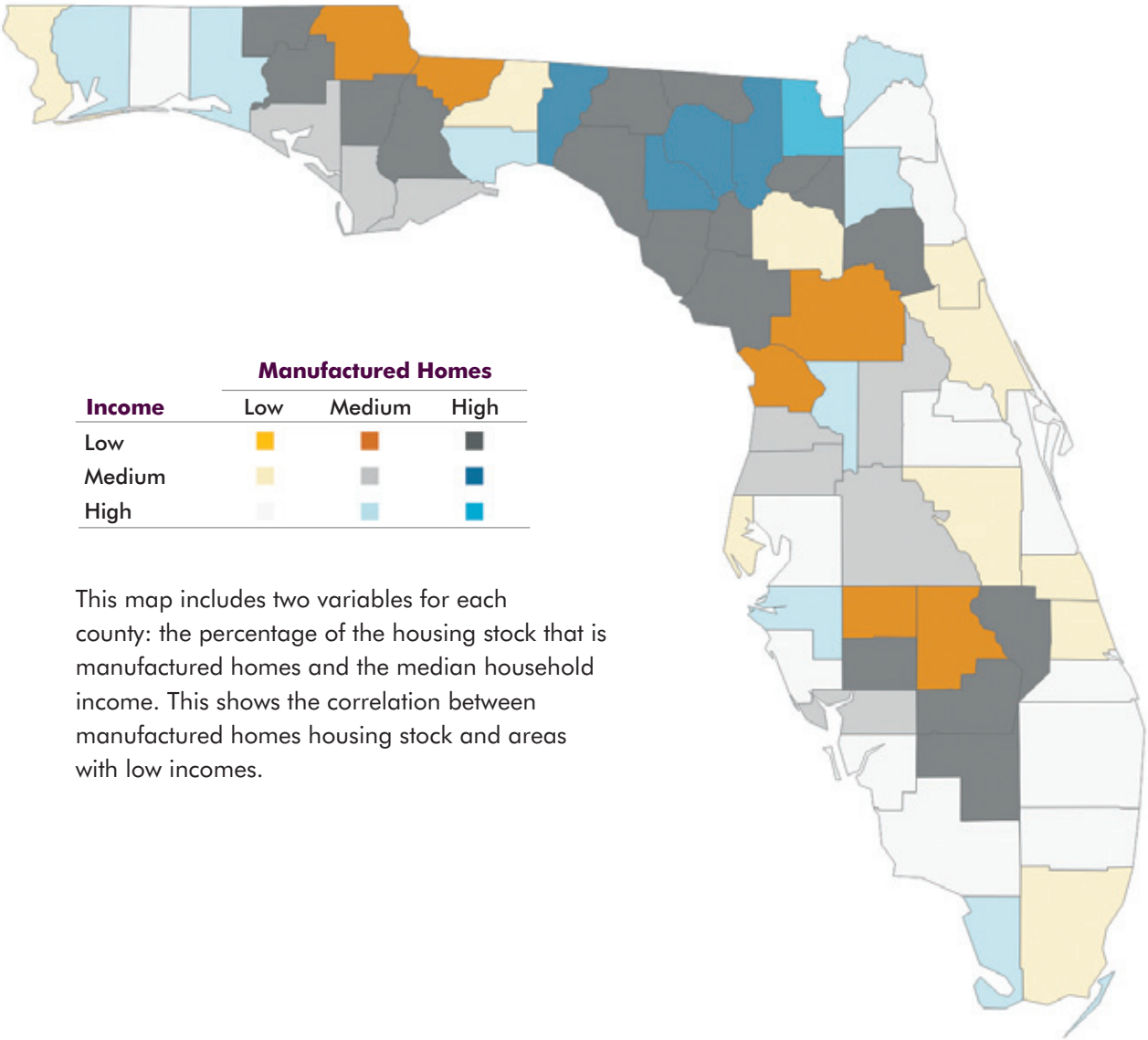
THE GEOGRAPHY OF FLORIDA'S MANUFACTURED HOMES

FIGURE FL1: **Total Manufactured Homes**



This map shows the total number of manufactured homes per county, as estimated in the US Census Bureau 2019 American Community Survey.

FIGURE FL2: **Manufactured Homes vs. Household Income**



	Manufactured Homes		
Income	Low	Medium	High
Low			
Medium			
High			

This map includes two variables for each county: the percentage of the housing stock that is manufactured homes and the median household income. This shows the correlation between manufactured homes housing stock and areas with low incomes.

TABLE FL2: **Communities and Homesites by Utility**

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Central Florida Electric Coop., Inc.	12	110	7
Choctawhatche Electric Coop., Inc.	59	331	39
City of Bartow, Florida (Utility Co.)	2	85	2
City of Blountstown, Florida (Utility Co.)	2	14	0
City of Bushnell, Florida (Utility Co.)	1	1	1
City of Chattahoochee, Florida (Utility Co.)	1	1	1
City of Clewiston, Florida (Utility Co.)	6	65	6
City of Fort Meade, Florida (Utility Co.)	1	10	0
City of Homestead, Florida (Utility Co.)	2	11	2
City of Key West, Florida (Utility Co.)	5	350	3
City of Lake Worth, Florida (Utility Co.)	6	481	6
City of Lakeland, Florida (Utility Co.)	187	12,930	138
City of Leesburg, Florida (Utility Co.)	1	1	1
City of Moore Haven, Florida (Utility Co.)	4	151	0
City of Mount Dora, Florida (Utility Co.)	1	113	0
City of New Smyrna Beach, Florida (Utility Co.)	2	58	2
City of Ocala, Florida (Utility Co.)	2	66	2
City of Quincy, Florida (Utility Co.)	1	12	0
City of Tallahassee, (Utility Co.)	11	338	10
City of Vero Beach, Florida (Utility Co.)	4	207	4
Clay Electric Coop., Inc.	86	3,099	33
Duke Energy Florida	1,263	113,351	846
Escambia River Electricity Coop., Inc.	17	58	10
Florida Keys Electricity Coop. Assn., Inc.	66	1476	38
Florida Power & Light Co.	1,501	172,642	1,002
Florida Public Utilities Co.	66	427	7
Fort Pierce Utilities Authority	6	80	6
Gainesville Regional Utilities	3	122	2
Georgia Power Co.	1	1	0
Glades Electric Coop., Inc	29	1,035	10
Gulf Coast Electric Coop., Inc.	46	992	10
Gulf Power Co.	631	8,482	318
Jacksonville Electric Authority	119	9,094	79
Kissimmee Utility Authority	4	64	4
Lea County Electric Coop., Inc.	64	4,721	48

TABLE FL2: **Communities and Homesites by Utility** (CONTINUED)

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Little Ocmulgee Electric Membership Corp.	1	14	0
Okefenoke Rural Electric Membership Corp.	18	57	5
Orlando Utilities Commission	20	442	10
Pacific Gas & Electric Co.	1	110	0
Peace River Electric Coop., Inc.	39	4,396	17
Potomac Electric Power Co.	1	34	0
Public Service Company of Oklahoma	4	29	0
Reedy Creek Improvement District	2	2	0
Sumter Electric Coop., Inc.	133	11,310	105
Suwannee Valley Electric Coop., Inc.	31	265	1
Talquin Electric Coop., Inc.	87	2,348	60
Tampa Electric Co.	570	31,285	372
Tri-County Electric Membership Corp.	12	170	0
West Florida Electric Coop. Association, Inc.	102	707	0
Withlacoochee River Electric Coop., Inc.	119	13,118	75

DATA ABOUT FLORIDA'S MANUFACTURED HOME COMMUNITIES

Community Size

TABLE FL3: **Number of Manufactured Home Communities by Size**

Category Range (sites in community)	Category Count	% of Total Communities with Site Counts
Large: >100	**1,085**	**46.03%**
>500	169	
300–499	252	
100–299	664	
Medium: 50–99	**278**	**11.79%**
75–99	125	
50–74	153	
Small: 1-49	**994**	**42.17%**
25–49	279	
1–24	715	
Communities without Site Counts	**2,744**	
Total Number of Communities	**5,101**	

TABLE FL4: **Homesites by Community Size**

Community Size	Sites	% of Sites
Large	349,706	89.64%
Medium	20,067	5.14%
Small	20,348	5.22%
Total Sites	**390,121**	**100%**

Community Income

1. State Median Household Income — $55,660

TABLE FL5: **Communities in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
Community Count	3,501	2,138	4,072	2,938
Site Count	289,542	183,207	321,446	224,285
% of Sites	74.22%	46.96%	82.40%	57.49%
% of Total Communities	71.14%	43.45%	82.75%	59.70%

TABLE FL6: **Income by Community Size**

		Small	Medium	Large
LMI Communities (by CBSA)	Community Count	654	200	821
	Site Count	13,613	14,411	261,518
	% of Sites	65.79%	71.94%	75.67%
	% of Total Communities	27.75%	8.49%	34.83%
Low-Income Communities (by CBSA)	Community Count	410	135	516
	Site Count	8,547	9,753	164,907
	% of Sites	41.25%	48.56%	47.56%
	% of Total Communities	17.39%	5.73%	21.89%

2. Communities Restricted to Ages 55+

TABLE FL7: **Total Number of Communities with Age Restrictions**

Number of Age-Restricted Communities	Sites	Percent of All Communities	Percent of All Sites
1,055	258,379	20.68%	66.23%

TABLE FL8: **Age-Restricted Communities in LMI Census Tracts (by CBSA)**

	Small	Medium	Large
Total Number	**76**	**123**	**733**
LMI Communities	56	86	567
% of Age-Restricted Communities	5.31%	8.15%	53.74%
Low-income	**33**	**56**	**348**
% Age-Restricted Communities	3.13%	5.31%	32.99%

Georgia

THE STATE'S MANUFACTURED HOUSING STOCK

Georgia has a large number of manufactured homes (384,876), according to the US Census Bureau, representing 9 percent of the state's housing stock, and ranking it the fifth largest total among all states. Most of these homes are located on privately owned individual plots of land rather than in manufactured home communities.

The Datacomp database has identified 735 manufactured home communities with 39,537 homesites, which accounts for only 10.3 percent as many houses as in the Census Bureau's estimate of manufactured homes. Although 355 of the communities in the Datacomp database do not include a count of homesites, it is clear that the vast majority of manufactured homes in Georgia are located outside of manufactured home communities.

Nevertheless, because there are so many manufactured homes in the state, even the small percentage in communities represents a significant number. Those communities with site counts span a range of sizes, with a roughly equal number of small and large communities. But because the large communities, by definition, have more homesites, most homesites (73.4 percent) are in the 140 large communities with over 100 homesites. Only seven communities have more than 500 homesites. Very few communities (18) are age restricted.

A high percentage of the communities in the Datacomp database are in a census tract that is low-income or moderate-income compared to the median household income of both the core-based statistical area (CBSA) and the state median household income of $58,700.

There has been a solid but not unusually active market for new manufactured homes in recent years, with 3,649 shipped to market in the state in 2019. This is a relatively small share of all new homes, given that 42,939 building permits were issued in 2019 for site-built, single-family homes.[1]

The state's manufactured home communities are spread widely across many utility service territories. This is unsurprising, given that Georgia has numerous utilities, including 45 rural electric cooperatives and 52 municipal utilities. About half of the communities and homesites in the Datacomp database are in the service territory of investor-owned utility Georgia Power. GreyStone Power Corporation, a cooperative in metropolitan Atlanta, is the utility with the nextmost homesites in the database (2,320). But given that most manufactured housing in

1 US Census Bureau, "U.S. Manufactured Housing Shipments by State: 2019," *https://www2.census.gov/programs-surveys/mhs/visualizations/2019/2019usmapbystate.pdf*; US Census Bureau, "Building Permits Survey Annual Data," *https://www.census.gov/construction/bps/stateannual.html*.

TABLE GA1: **Georgia Communities and Sites in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
% of Sites	60.17%	36.20%	61.31%	43.87%
% of Total Communities	63.58%	36.27%	75.37%	54.78%

Georgia is not in communities but on individual plots of land, there are undoubtedly large numbers of manufactured homes in the service territories of many other utilities.

THE STATE'S SOLAR LANDSCAPE

Solar development in Georgia has accelerated in recent years and the state ranked fifth in new capacity in 2019.[2] However, the vast majority of that capacity has taken the form of utility-scale and large commercial projects. The residential market, while growing, is still small. Georgia allows third-party ownership of residential systems through leases and power purchase agreements.

State Policies and Utility Programs. For many years, Georgia Power, the state's only investor-owned utility, compensated homeowners generating solar power at the "avoided cost" rate, below the retail rate of electricity. In 2019, however, the Georgia Public Service Commission issued an order requiring Georgia Power to use monthly netting, a program akin to net metering, for up to 5,000 residential solar customers or until new installed solar capacity reaches 32 megawatts (MW). This improved the value proposition for Georgia Power residential solar considerably.[3] Many municipally owned utilities in Georgia impose fees on customers with solar installations.[4]

Georgia Power has a range of solar programs providing guidance to customers who are considering solar and serving as an installer. The company also facilitates participation in community solar by offering customers the ability to purchase blocks of electricity in community solar projects, but the company tells customers that they should not expect to save money on their bills.[5]

The state's rural electric cooperatives have been increasingly active in investing in utility-scale solar projects and offering community solar. A 2017 article by the National Renewable Electric Cooperative Association (NRECA) reported that Georgia coops were adding more solar capacity in that year than the coops of any other state.[6] Green Power EMC, a nonprofit Georgia-based coop, was founded in 2001 to help the state's rural electric coops develop

2 Solar Energy Industries Association, "Georgia Solar" webpage, accessed September 20, 2020, *https://www.seia.org/state-solar-policy/georgia-solar.*

3 Solar Power World, "Georgia PSC Approves Net Metering for up to 5,000 Solar Customers," December 17, 2019, accessed September 24, 2020, *https://www.solarpowerworldonline.com/2019/12/georgia-psc-approves-solar-net-metering.*

4 Cesar Prieto and Seth Gunning, "Utility Barriers to Rooftop Solar in Georgia," (PV Magazine, November 4, 2019), *https://pv-magazine-usa.com/2019/11/04/utility-barriers-to-rooftop-solar-in-georgia.*

5 Georgia Power, "Solar Programs" webpage, accessed September 20, 2020, *https://www.georgiapower.com/company/energy-industry/energy-sources/solar-energy/solar.html*

6 National Rural Electric Cooperative Association, "Cooperative Solar Skyrockets," March 9, 2017, *https://www.electric.coop/cooperative-solar-skyrockets.*

and procure renewable energy. It works with 38 of the state's coops and has been playing a leading role in solar development for them. It also advises individual homeowners and businesses on whether they can profitably install solar.[7] According to NRECA, "Green Power EMC and its members have been involved in building or procurement of 245 megawatts of solar power. Pending commitments through 2021 are expected to raise that total to about 1,000 MW."[8] Georgia's Walton EMC, one of the largest electric cooperatives in the country, has also demonstrated considerable interest in solar development.[9]

In 2010, Georgia enacted legislation that authorized on-bill financing programs to assist rural electric cooperative members reduce their energy costs. Several coops have implemented on-bill financing, and these programs could potentially be used to finance solar for manufactured homes.[10]

Economics of a Typical PV System. The cost analysis undertaken for this project of a 4-kW system suggests that the economics of PV are more favorable than in some states, but significant new financial incentives would be necessary to help LMI homeowners pay for the upfront costs, or companies would need to be recruited to offer third-party-owned systems at favorable prices.

RECOMMENDATIONS

Any solar initiative for manufactured housing would need new funding to make solar financially beneficial for the LMI residents. The most logical starting point would be a modest pilot initiative that could be offered in one or a few locations. The key to offering such an initiative would be finding willing partners able to provide some of the needed funding. This could be a state-funded program or could involve a utility. It might also be possible to recruit a philanthropic foundation or a community-based organization that seeks to improve the lives of Georgia's low-income households.

The existence of Green Power EMC and the strong interest that the state's rural electric coops have shown in solar development suggest that the coops are potential partners for an LMI solar initiative. Outreach could determine which coops might embrace solar for manufactured home communities as a way to alleviate poverty and reduce delinquent bill payments. With on-bill financing programs already offered by some Georgia electric cooperatives,[11] it could be further explored and expanded as a financing mechanism for LMI solar.

A pilot initiative could take one of several forms. There are a sufficient number of large manufactured home communities that could be the focus of a pilot for one or more of the utilities A marketing campaign could be efficient if it used the community's homeowners association and other mechanisms for disseminating information within the community. A Solarize-style

7 Green Power EMC website, *http://www.greenpoweremc.com*.

8 National Rural Electric Cooperative Association, "Electric Co-ops are Making Solar Power Part of Georgia's Future," December 11, 2018, *https://www.electric.coop/electric-co-ops-making-solar-energy-part-georgias-future*.

9 Southern Alliance for Clean Energy, "Solar in the Southeast," June 23, 2020, *https://cleanenergy.org/wp-content/uploads/Solar-in-the-Southeast-Report-2020.pdf*.

10 National Conference of State Legislatures, "On-Bill Financing: Cost-free Energy Efficiency Improvements," April 7, 2015, *https://www.ncsl.org/research/energy/on-bill-financing-cost-free-energy-efficiency-improvements.aspx*.

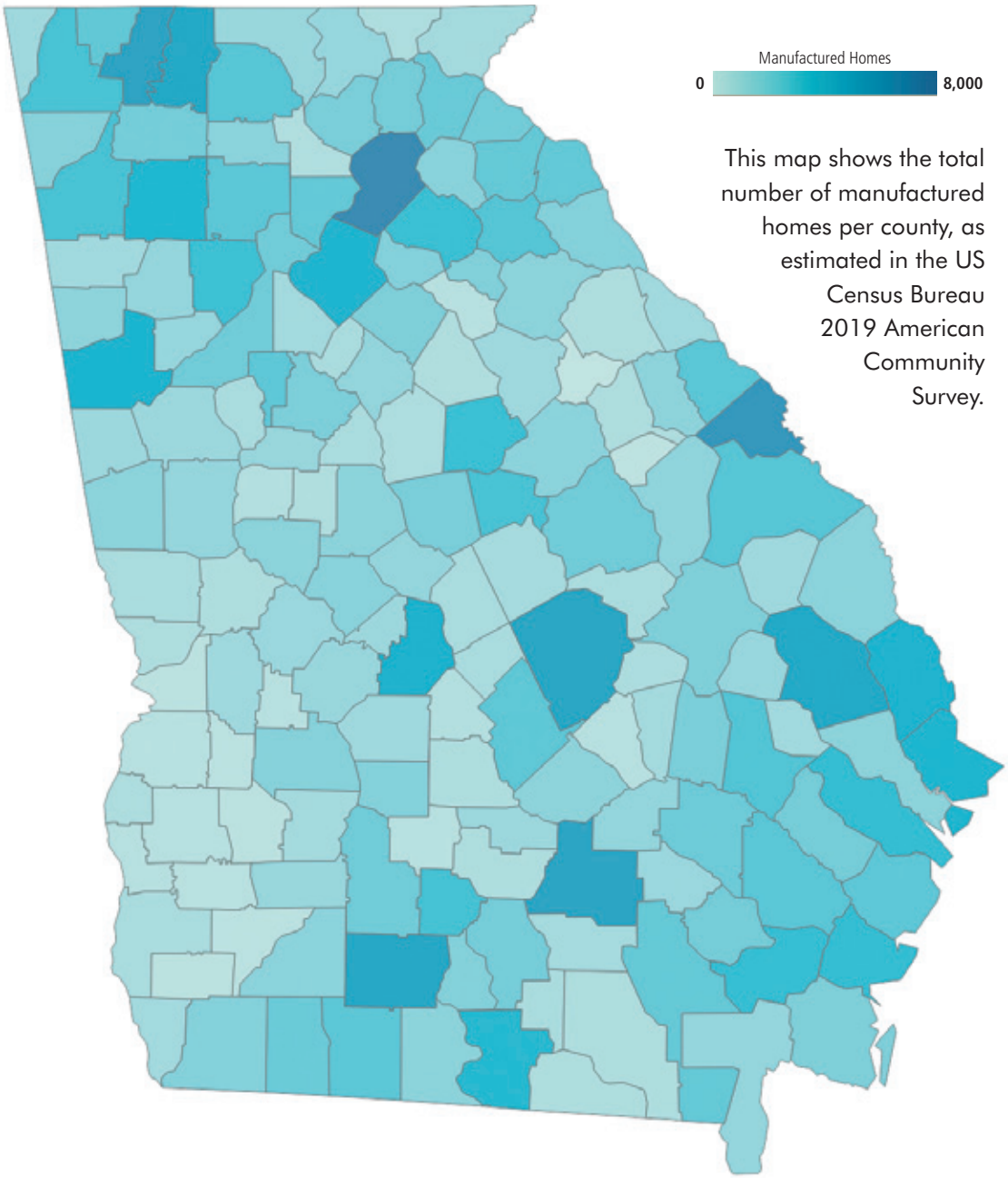
11 Southeast Energy Efficiency Alliance, "On-Bill Finance" webpage, accessed September 24, 2020, *https://www.seealliance.org/initiatives/low-income-financing*.

campaign could work well in such a setting—by either seeking to offer a large number of identical rooftop, ground-mounted or pole-mounted systems, or by seeking subscribers to a shared community solar project.

Alternatively, an initiative could focus on the larger number of manufactured homes that are not in communities. In that case, the best strategy could be a Solarize-type campaign aimed at all LMI single-family homes in a specific geographic area, not just those that are manufactured homes. If the goal is to bring solar to LMI homeowners, there would not be a reason to exclude LMI houses that are not manufactured homes. But the technology solutions offered would need to work with both manufactured homes and site-built homes.

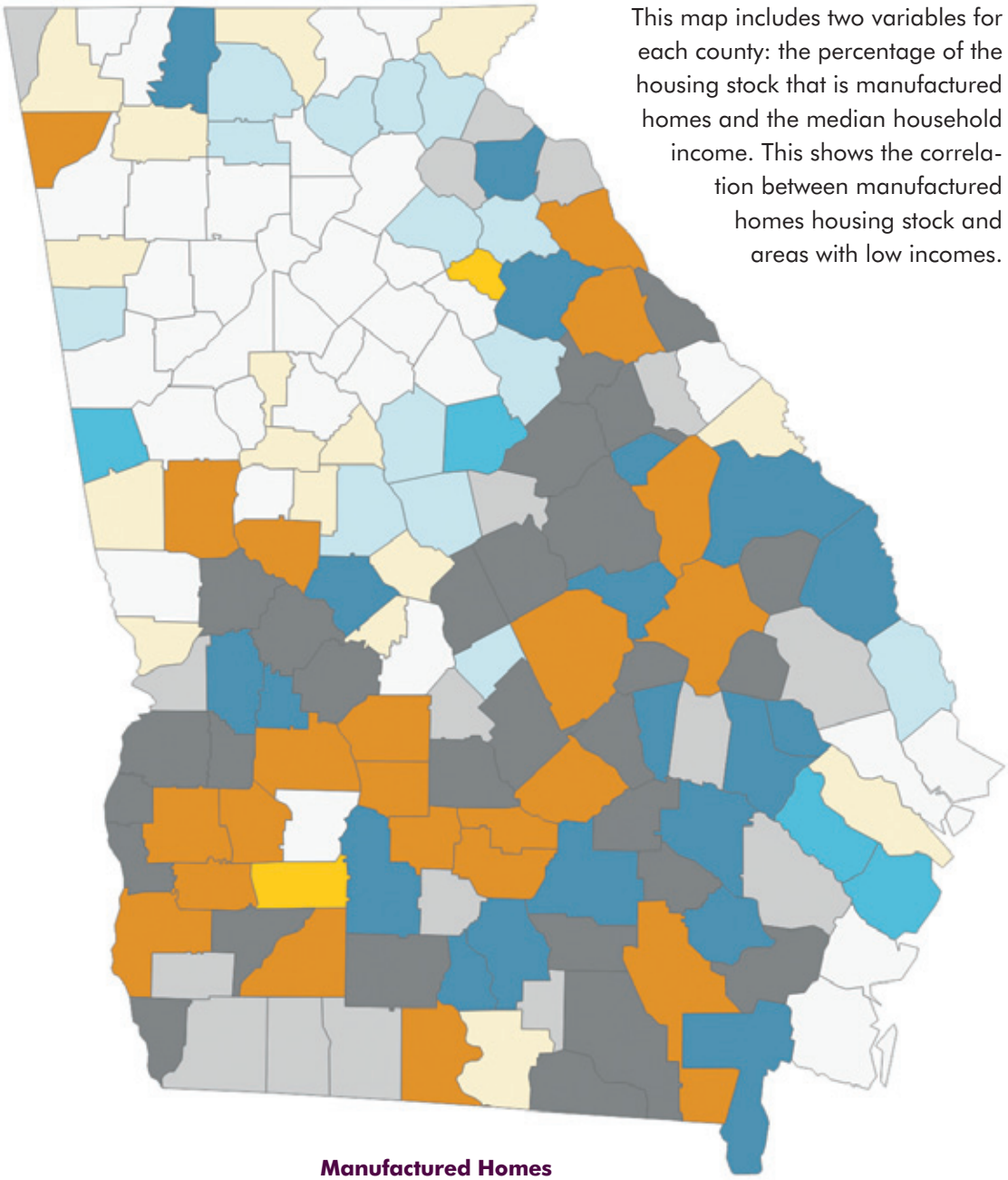
THE GEOGRAPHY OF GEORGIA'S MANUFACTURED HOMES

FIGURE GA1: **Total Manufactured Homes**



This map shows the total number of manufactured homes per county, as estimated in the US Census Bureau 2019 American Community Survey.

FIGURE GA2: **Manufactured Homes vs. Household Income**



This map includes two variables for each county: the percentage of the housing stock that is manufactured homes and the median household income. This shows the correlation between manufactured homes housing stock and areas with low incomes.

	Manufactured Homes		
Income	Low	Medium	High
Low			
Medium			
High			

TABLE GA2: **Communities and Homesites by Utility**

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Albany Water Gas & Light Commission	8	335	7
Altamaha Electric Membership Corp.	4	91	1
Amicalola Electric Membership Corp.	2	0	0
Appalachian Power Co.	1	1	0
Blue Ridge Mtn. Electric Membership Corp.	1	50	0
Canoochee Electric Membership Corp.	5	41	1
Carroll Electric Membership Corp.	15	141	8
Central Georgia Electric Membership Corp.	8	1,029	6
City of Barnesville, Georgia (Utility Co.)	1	1	0
City of Blakely, Georgia (Utility Co.)	2	43	0
City of Buford, Georgia (Utility Co.)	1	144	0
City of Chattanooga, Georgia (Utility Co.)	5	541	4
City of Chickamauga, Georgia (Utility Co.)	1	1	0
City of Douglas, Georgia (Utility Co.)	1	1	1
City of Jackson, Georgia (Utility Co.)	1	20	0
City of La Grange, Georgia (Utility Co.)	3	3	3
City of Lawrenceville, Georgia (Utility Co.)	1	1	0
City of Marietta, Georgia (Utility Co.)	5	322	4
City of Monticello, Georgia (Utility Co.)	1	35	0
City of Moultrie, Georgia (Utility Co.)	1	1	0
City of Sylvester, Georgia (Utility Co.)	1	45	0
City of Thomasville, Georgia (Utility Co.)	1	15	0
Coastal Electric Membership Corp.	4	127	2
Cobb Electric Membership Corp.	22	1,662	5
Colquitt Electric Membership Corp.	26	838	11
Coweta-Fayette Electric Membership Corp.	7	1,034	2
Crisp County Power Commission	3	37	3
Dalton Utilities	2	0	1
Diverse Power, Inc.	9	41	9
Duke Energy Carolinas, LLC	1	1	0
Excelsior Electric Membership Corp.	7	373	3
Fitzgerald Water Light & Bond Commission	2	36	1
Flint Electric Membership Corp.	24	1,034	10
Fort Valley Utility Commission	1	91	1
Georgia Power Co.	345	19,046	184

TABLE GA2: **Communities and Homesites by Utility** (CONTINUED)

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Grady Electric Membership Corp.	9	290	6
GreyStone Power Corp.	17	2,320	10
Hart Electric Membership Corp.	4	142	2
Jackson Electric Membership Corp.	31	1,465	14
Jay County Rural Electric Membership Corp.	1	1	0
Jefferson Electric Membership Corp.	7	206	4
Little Ocmulgee Electric Membership Corp.	2	88	1
Middle Georgia Electric Membership Corp.	1	1	1
Mitchell Electric Membership Corp.	18	927	10
Newnan Water, Sewer & Light Commission	1	150	0
North Georgia Electric Membership Corp.	21	662	8
Ocmulgee Electric Membership Corp.	1	50	1
Oconee Electric Membership Corp.	2	21	1
Okefenoke Electric Membership Corp.	5	645	2
Pataula Electric Membership Corp.	2	42	2
Planters Electric Membership Corp.	2	33	2
Rayle Electric Membership Corp.	1	22	0
Satilla Rural Electric Membership Corp.	18	744	13
Sawnee Electric Membership Corp.	2	242	0
Slash Pine Electric Membership Corp.	1	1	0
Snapping Shoals Electric Membership Corp.	8	531	3
Sumter Electric Membership Corp.	6	213	6
Tennessee Valley Authority (Mississippi)	42	1,746	19
Tri-County Electric Membership Corp.	1	42	0
Upson Electric Membership Corp.	2	31	1
Walton Electric Membership Corp.	9	1,143	0

DATA ABOUT GEORGIA'S MANUFACTURED HOME COMMUNITIES

Community Size

TABLE GA3: **Number of Manufactured Home Communities by Size**

Category Range (sites in community)	Category Count	% of Total Communities with Site Counts
Large: >100	**140**	**36.84%**
>500	7	
300–499	14	
100–299	119	
Medium: 50–99	**95**	**25.00%**
75–99	33	
50–74	62	
Small: 1-49	**145**	**38.16%**
25–49	86	
1–24	59	
Communities without Site Counts	**355**	
Total Number of Communities	**735**	

TABLE GA4: **Homesites by Community Size**

Community Size	Sites	% of Sites
Large	29,027	73.42%
Medium	6,538	16.54%
Small	3,972	10.05%
Total Sites	**39,537**	**100%**

Community Income

1. State Median Household Income — $58,700

TABLE GA5: **Communities in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
Community Count	426	243	505	367
Site Count	23,788	14,312	24,240	17,345
% of Sites	60.17%	36.20%	61.31%	43.87%
% of Total Communities	63.58%	36.27%	75.37%	54.78%

TABLE GA6: **Income by Community Size**

		Small	Medium	Large
LMI Communities (by CBSA)	Community Count	67	51	89
	Site Count	1,897	3,600	18,291
	% of Sites	46.21%	53.68%	63.57%
	% of Total Communities	17.63%	13.42%	23.42%
Low-Income Communities (by CBSA)	Community Count	29	26	53
	Site Count	847	1,869	11,596
	% of Sites	20.00%	27.37%	37.86%
	% of Total Communities	7.63%	6.84%	13.95%

2. Communities Restricted to Ages 55+

TABLE GA7: **Total Number of Communities with Age Restrictions**

Number of Age-Restricted Communities	Sites	Percent of All Communities	Percent of All Sites
18	1,327	2.45%	3.36%

TABLE GA8: **Age-Restricted Communities in LMI Census Tracts (by CBSA)**

	Small	Medium	Large
Total Number	**7**	**3**	**7**
LMI Communities	2	2	1
% of Age-Restricted Communities	11.11%	11.11%	5.56%
Low-income	**1**	**0**	**0**
% Age-Restricted Communities	5.56%	0.00%	0.00%

Kentucky

THE STATE'S MANUFACTURED HOUSING STOCK

A high percentage (12 percent) of Kentucky's housing stock consists of manufactured housing, according to the US Census Bureau, which estimates there are 234,488 manufactured homes in the state. The majority of these homes are on privately owned individual plots of land rather than in manufactured home communities.

The Datacomp database has identified 1,173 manufactured home communities with 35,196 homesites, which accounts for only 14.8 percent as many houses as counted by the Census Bureau. Although 560 of the communities in the database do not include a count of homesites, it is clear that most manufactured homes in Kentucky are located outside of manufactured home communities.

Most of the manufactured home communities are small, with 66 percent having fewer than 49 homesites and 47 percent having fewer than 24 homesites, according to Datacomp. The communities missing site counts in the database are also very likely small. But because the large communities, by definition, have more homesites, most homesites (59.4 percent) are in the 101 largest communities with over 100 homesites. Only three communities have more than 500 homesites. Very few communities (10) are age restricted.

Compared to most of the other target states, a smaller percentage of the manufactured home communities listed in the Datacomp database are in a census tract that is low-income or moderate-income compared to the median household income of its core-based statistical area (CBSA). The percentage of homesites in LMI census tracts is higher. When compared to the state median household income of $50,589, the percentage of communities and sites that are LMI and low-income is also higher. This emphasizes that most of the communities are in parts of the state with below-average area incomes (see maps at the end of this section).

Manufactured housing has been a significant share of the new homes in the state in recent years. In 2019, 2,792 manufactured homes were shipped to market, compared to 7,467 building permits issued in that same year for site-built, single-family homes.[1]

More than 70 percent of the manufactured home communities and identified homesites are in the service territory of Kentucky Utilities/Old Dominion Power. The remaining communities and sites are spread across the other utilities, including many of the state's 25 rural electric

1 US Census Bureau, "U.S. Manufactured Housing Shipments by State: 2019," *https://www2.census.gov/programs-surveys/mhs/visualizations/2019/2019usmapbystate.pdf*; US Census Bureau, "Building Permits Survey Annual Data," *https://www.census.gov/construction/bps/stateannual.html*.

TABLE KY1: **Kentucky Communities and Sites in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
% of Sites	53.13%	27.38%	61.86%	28.17%
% of Total Communities	41.11%	19.22%	69.02%	38.53%

cooperatives and 29 municipal utilities. But given that most of the manufactured housing in Kentucky is not located in communities but on individual plots of land, there are undoubtedly large numbers of manufactured homes in the service territories of many utilities.

THE STATE'S SOLAR LANDSCAPE

Kentucky presents a challenging environment for expanding solar energy for LMI manufactured homes. Overall, relatively little solar has been developed in the state. It ranks 48th among states in total solar capacity and 46th in the amount of capacity added in 2020.[2] Kentucky electricity costs are relatively low.

State Policies. In 2019, the Kentucky legislature passed Senate Bill 100, signed by Governor Andy Beshear, that significantly scaled back net metering in the state. This law allows the Public Service Commission (PSC), a board appointed by the governor, to set new rates for how utilities will pay residents with solar panels for their excess electricity generation, but the changes in compensation for solar customers will not go into effect until the Commission rules on particular utility rate cases. In May 2020, Kentucky Power Company became the first regulated utility in the state under the new law to petition for a change to its net metering tariff, which would have the effect of lowering customers' compensation rate for solar surplus generation. In January 2021, the PSC delayed a decision on the net metering proposal until a consultant can provide advice to the Commission.[3] Kentucky does allow third-party solar ownership.

Economics of a Typical PV System. With low electricity rates and weak compensation for solar, this project's analysis of typical costs for a 4-kW system in Kentucky showed the least favorable financial returns of any of the 14 target states. Very large financial incentives would be necessary to help LMI homeowners pay for the upfront costs of solar. Part of the reason for this is that installation costs are higher in Kentucky than in most states. Costs would likely fall as the market expands, creating more competition and strengthening economies of scale.

Utility Activities. Some solar is already being developed in Kentucky, especially at the utility and commercial scale, including by rural coops. Responding to members' requests for options that include renewable energy, in 2017 Farmers RECC partnered with other Kentucky Touchstone Energy cooperatives serving south-central Kentucky to develop a not-for-profit, 60-acre, community solar array. This solar array features 32,200 solar panels totaling 8.5 megawatts.[4] With a one-time payment of $460 per panel, participating members obtain a

2 Solar Energy Industries Association, "Kentucky Solar" webpage, accessed March 22, 2021, *https://www.seia.org/state-solar-policy/kentucky-solar.*

3 Kentucky Solar Energy Society, "News" webpage, accessed March 22, 2021, *https://www.kyses.org.*

4 "Electric co-ops dedicate 60-acre solar farm in Clark County." (2017), *https://www.lanereport.com/83153/2017/11/electric-co-ops-dedicate-60-acre-solar-farm-in-clark-county.*

25-year license and receive a credit on their monthly electricity bills for the value of the energy generated by their share of the solar array. In May 2020, Big Rivers Electric Corporation, a rural electric cooperative serving western Kentucky, entered a power purchase agreement with two developers to build a community solar array that will provide up to 260 megawatts of energy, currently the largest solar energy project in Kentucky. Each of Big Rivers members will financially benefit from the long-term, fixed price electricity this solar project will generate.

At least five rural electric coops, including Farmers RECC, offer on-bill financing for energy efficiency.

RECOMMENDATIONS

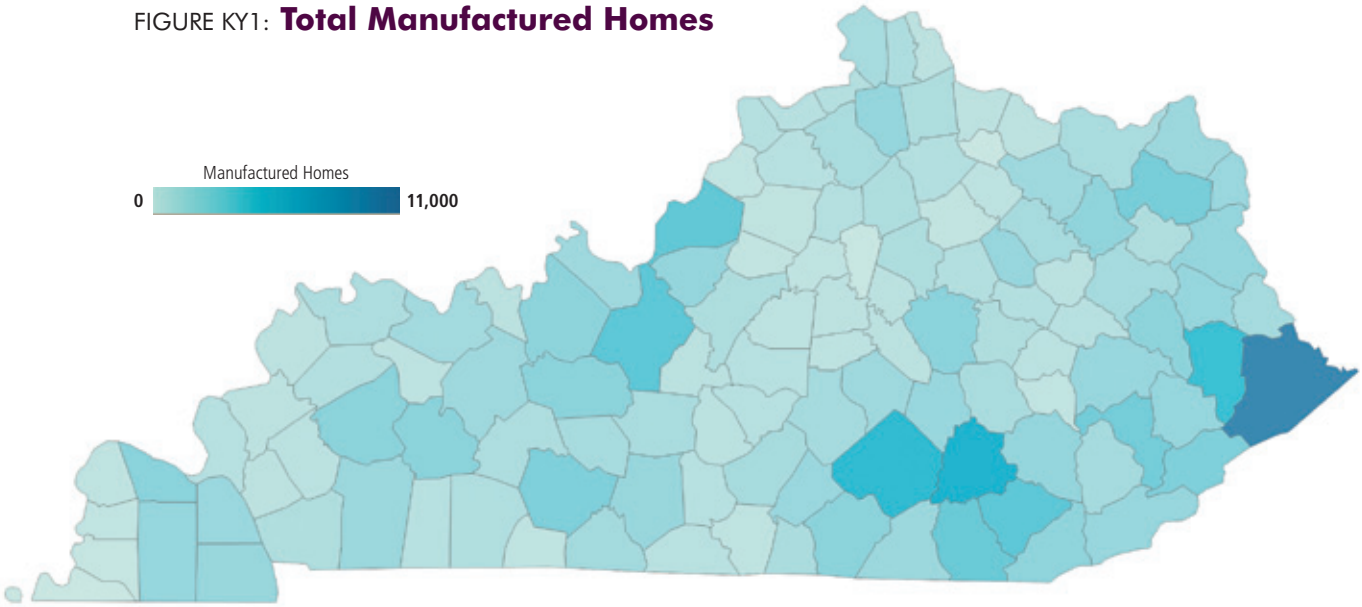
Given the economics of solar in Kentucky, it would be difficult to launch a major initiative for solar for manufactured homes. It might be more feasible to focus on a few small demonstration projects to show Kentucky residents that solar for manufactured homes is possible and can bring down energy costs under the right circumstances.

Outreach to the state's municipal utilities and rural coops could determine whether one of them might be interested in being a partner for a demonstration project. It might also be possible to recruit a philanthropic foundation or other community-based organization that seeks to improve the lives of Kentucky's low-income households. Perhaps the demonstration project could be linked to an effort to aid in the transition from coal to clean energy and include a jobs training component.

Manufactured homes are a sufficiently large part of the new homes market in Kentucky, so it would be good to encourage dealers and manufacturers to offer an option for house purchasers to buy a solar-ready home.

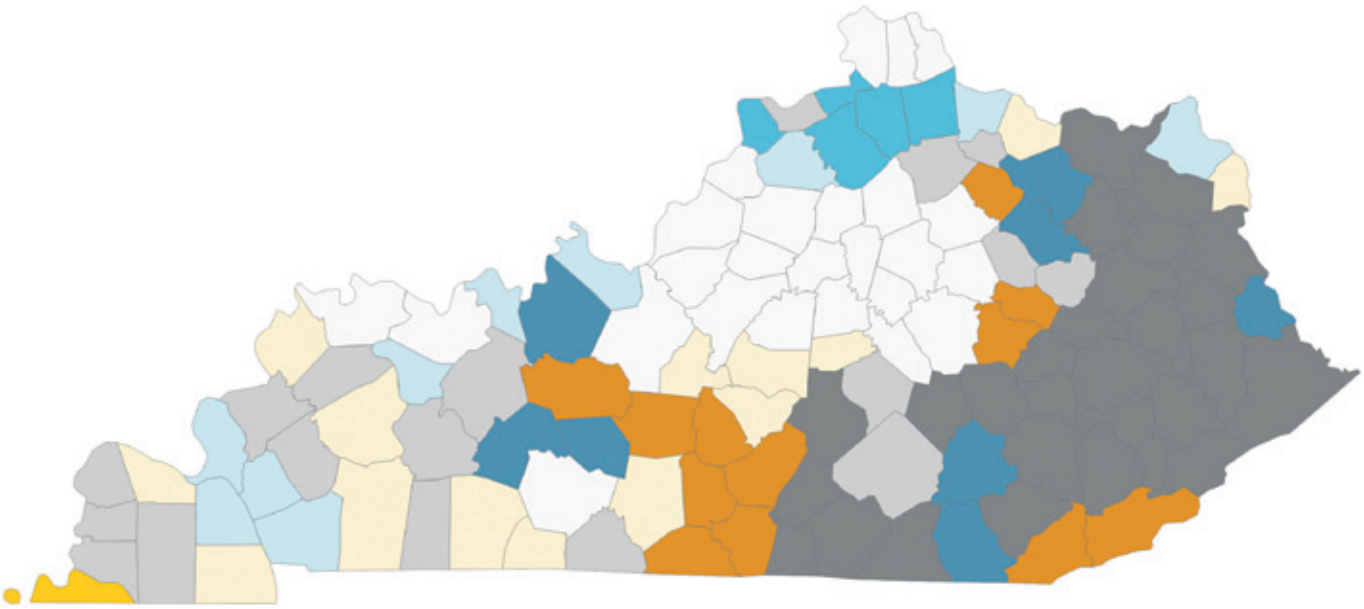
THE GEOGRAPHY OF KENTUCKY'S MANUFACTURED HOMES

FIGURE KY1: **Total Manufactured Homes**



This map shows the total number of manufactured homes per county, as estimated in the US Census Bureau 2019 American Community Survey.

FIGURE KY2: **Manufactured Homes vs. Household Income**



	Manufactured Homes		
Income	Low	Medium	High
Low			
Medium			
High			

This map includes two variables for each county: the percentage of the housing stock that is manufactured homes and the median household income. This shows the correlation between manufactured homes housing stock and areas with low incomes.

TABLE KY2: **Communities and Homesites by Utility**

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Barbourville Utility Commission	5	99	1
Benton County	2	1	0
Big Sandy Rural Elec Coop. Corp.	4	74	0
Blue Grass Energy Coop. Corp.	17	448	6
City of Bardstown, Kentucky (Utility Co.)	3	129	1
City of Bardwell, Kentucky (Utility Co.)	1	1	0
City of Benton, Kentucky (Utility Co.)	2	2	0
City of Berea Municipal Utility, Kentucky	3	53	2
City of Bowling Green, Kentucky (Utility Co.)	14	807	11
City of Clinton, Tennessee (Utility Co.)	1	1	0
City of Frankfort, Kentucky (Utility Co.)	11	378	4
City of Franklin, Kentucky (Utility Co.)	6	298	0
City of Fulton, Kentucky (Utility Co.)	1	0	0
City of Glasgow, Kentucky (Utility Co.)	5	17	4
City of Hopkinsville, Kentucky (Utility Co.)	8	102	5
City of Jellico, Tennessee (Utility Co.)	1	1	1
City of Mayfield Plant Board, KY (Utility Co.)	3	8	3
City of Murray, Kentucky (Utility Co.)	2	0	0
City of Nicholasville, Kentucky (Utility Co.)	1	38	1
City of Olive Hill, Kentucky (Utility Co.)	1	1	0
City of Owensboro, Kentucky (Utility Co.)	1	1	1
City of Paducah, Kentucky (Utility Co.)	29	531	23
City of Paris, Kentucky (Utility Co.)	1	1	1
City of Princeton, Kentucky (Utility Co.)	7	65	0
City of Russellville, Kentucky (Utility Co.)	3	160	0
City of Vanceburg, Kentucky (Utility Co.)	4	37	0
Clark Energy Coop., Inc.	12	145	2
Corbin City Utilities Commission	6	45	0
Cumberland Valley Rural Electric Coop. Corp.	7	57	2
Duke Energy Kentucky, Inc.	39	3,720	25
Farmers Rural Electric Coop. Corp.	11	78	4
Fleming-Mason Energy Coop., Inc.	8	263	0
Grayson Rural Electric Coop. Corp.	3	130	0
Henderson City Utility Commission	2	6	2
Inter County Energy Coop. Corp.	11	220	3

TABLE KY2: **Communities and Homesites by Utility** (CONTINUED)

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Jackson Energy Coop. Corp.	14	98	3
Jackson Purchase Energy Corp.	36	517	5
Kenergy Corp.	46	2,196	17
Kentucky Power Co.	118	1,572	12
Kentucky Utilities Co.	505	14,556	208
Licking Valley Rural Electric Coop.	6	53	0
Louisville Gas & Electric Co.	52	5,356	44
Madisonville Municipal Electric Utilities	9	263	1
Meade County Rural Electric Coop. Corp.	20	306	0
Nolin Rural Electric Coop. Corp.	42	278	9
Old Dominion Power Co.	350	10,837	139
Owen Electric Coop., Inc.	21	1,184	8
Pennyrile Rural Electric Coop.	39	923	24
Salt River Electric Coop. Corp.	15	1,110	8
Shelby Energy Co-op., Inc.	8	32	0
South Kentucky Rural Electric Coop. Corp.	39	546	8
Taylor County Rural Electric Coop. Corp.	12	247	5
Tennessee Valley Authority (Mississippi)	368	6,720	131
Tri-County Electric Membership Corp.	19	48	8
Warren Rural Electric Coop. Corp.	40	1,329	14
West Kentucky Rural Electric Coop. Corp.	33	666	7
Williamstown Utility Commission	2	78	2

DATA ABOUT KENTUCKY'S MANUFACTURED HOME COMMUNITIES

Community Size

TABLE KY3: **Number of Manufactured Home Communities by Size**

Category Range (sites in community)	Category Count	% of Total Communities with Site Counts
Large: >100	**101**	**16.48%**
>500	3	
300–499	16	
100–299	82	
Medium: 50–99	**106**	**17.29%**
75–99	32	
50–74	74	
Small: 1-49	**406**	**66.23%**
25–49	116	
1–24	290	
Communities without Site Counts	**560**	
Total Number of Communities	**1,173**	

TABLE KY4: **Homesites by Community Size**

Community Size	Sites	% of Sites
Large	20,917	59.43%
Medium	7,133	20.27%
Small	7,146	20.30%
Total Sites	**35,196**	**100%**

Community Income

1. State Median Household Income — $50,589

TABLE KY5: **Communities in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
Community Count	430	201	722	0
Site Count	18,700	9,637	21,774	9,915
% of Sites	53.13%	27.38%	61.86%	28.17%
% of Total Communities	41.11%	19.22%	69.02%	38.53%

TABLE KY6: **Income by Community Size**

		Small	Medium	Large
LMI Communities (by CBSA)	Community Count	119	45	66
	Site Count	2,042	2,893	13,765
	% of Sites	29.31%	42.45%	65.35%
	% of Total Communities	19.41%	7.34%	10.77%
Low-Income Communities (by CBSA)	Community Count	61	14	34
	Site Count	1,071	1,090	7,476
	% of Sites	15.02%	13.21%	33.66%
	% of Total Communities	9.95%	2.28%	5.55%

2. Communities Restricted to Ages 55+

TABLE KY7: **Total Number of Communities with Age Restrictions**

Number of Age-Restricted Communities	Sites	Percent of All Communities	Percent of All Sites
10	914	0.85%	2.60%

TABLE KY8: **Age-Restricted Communities in LMI Census Tracts (by CBSA)**

	Small	Medium	Large
Total Number	**4**	**3**	**3**
LMI Communities	0	1	3
% of Age-Restricted Communities	0.00%	10.00%	30.00%
Low-income	**0**	**0**	**1**
% Age-Restricted Communities	0.00%	0.00%	10.00%

Maine

THE STATE'S MANUFACTURED HOUSING STOCK

Maine has 61,283 manufactured homes, according to the US Census Bureau, representing 8.3 percent of the state's housing stock. Most of these homes are located on individual privately owned plots of land rather than in manufactured home communities.

The Datacomp database has identified 327 manufactured home communities with 13,186 homesites, which accounts for 21.5 percent as many houses as noted in the Census Bureau's counts. The database has homesite counts for fewer of these communities (only 42.2 percent) than for most other states. That suggests that there could be more homes in communities than reported in the database, but it is likely that most manufactured homes in Maine are located outside of manufactured home communities.

Those communities with site counts span a range of sizes, but most can be characterized as somewhat small. But because the large communities, by definition, have more homesites, most homesites (71.1 percent) are located in the 43 large communities with over 100 homesites. Only one community has more than 500 homesites. Relatively few communities (22) are age restricted. There are eight resident-owned communities (ROCs). About three-quarters of the communities and 80 percent of the identified homesites are in the service territory of the state's largest utility, Central Maine Power.

Compared to most of the other target states, a smaller percentage of the communities and homesites in the Datacomp database are in a census tract that is low-income or low- to-moderate income LMI, compared to the median household income of its core-based statistical area (CBSA). The share of communities that are in LMI census tracts is somewhat higher when compared to the state median household income of $57,918, but the percentage of LMI and low-income homesites remains low compared to the state media. There are several possible explanations for this, but it is likely that more community residents have above-average incomes than in other states.

Maine has relatively limited new manufactured home construction activity. In 2019, 635 manufactured homes were shipped to market, compared to 3,474 building permits issued in that same year for site-built, single-family homes.[1]

1 US Census Bureau, "U.S. Manufactured Housing Shipments by State: 2019," *https://www2.census.gov/programs-surveys/mhs/visualizations/2019/2019usmapbystate.pdf*; US Census Bureau, "Building Permits Survey Annual Data," *https://www.census.gov/construction/bps/stateannual.html*.

TABLE ME1: **Maine Communities and Sites in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
% of Sites	38.12%	11.91%	30.15%	9.43%
% of Total Communities	29.49%	11.52%	52.07%	27.19%

THE STATE'S SOLAR LANDSCAPE

Maine is a small state with a level of solar capacity proportionate to its population. The state ranks 42nd in population and 39th in total installed solar capacity. However, Governor Janet Mills has expressed strong interest in accelerating clean energy development and actions by her administration have contributed to an uptick in solar development. The state had the 29th most solar capacity installed in 2020.[2]

State and Municipal Policies and Programs. In 2019, Governor Mills signed into law LD 91, *An Act to Eliminate Gross Metering*, reversing the "gross metering" policy of the previous governor and reinstating net metering for all Mainers. This law is described as ensuring that residents who generate electricity from solar panels will be compensated fairly for supplying excess energy to the electric grid, receiving 1-to-1 net metering credits at the retail rate. Any unused excess net metering credits at the end of a year become null and void and cannot be rolled over into the next year.

Also in 2019, Maine raised the cap on the number of participants allowed for net metering in a community solar array from nine to 200 and removed the cap for the number of customers participating in community solar projects procured competitively. This effectively opened Maine's community shared-solar market.[3] The law requires 10 percent of each larger-scale community solar project to serve LMI households.[4] Third-party ownership of residential solar projects is allowed.

In September 2020, the Maine Public Utilities Commission approved contracts for 546 megawatts of renewable power, the state's largest solicitation of renewable projects, and 482.5 megawatts of new solar development.[5]

The Maine Governor's Energy Office has been exploring strategies for promoting LMI solar and is seeking ways to bring down energy costs for LMI households. Maine's relatively high electricity costs (10th among all states) provide some of the motivation for addressing LMI households' electricity bills.

2 Solar Energy Industries Association, "Maine Solar" webpage, accessed March 22, 2021, *https://www.seia.org/state-solar-policy/maine-solar.*

3 See Solar Power World, "PowerMarket and SunRaise Bring Some of the First Community Solar Projects to Maine," September 22, 2020, *https://www.solarpowerworldonline.com/2020/09/powermarket-sunraise-community-solar-projects-maine*. See also Coalition for Community Solar Access, "Maine Becomes 20th State to Pass Community Solar Legislation," June 26th, 2019, *http://www.communitysolaraccess.org/maine-becomes-20th-state-to-pass-community-solar-legislation*.

4 Natural Resources Council of Maine, "Support LD 1711" factsheet, accessed September 24, 2020, *https://www.nrcm.org/wp-content/uploads/2019/05/LD1711solarpositionmemo.pdf.*

5 UtilityDive, "Maine Regulators OK State's Largest Renewable Solicitation with 482 MW Solar, but Skip Storage," September 23, 2020, accessed September 24, 2020, *https://www.utilitydive.com/news/maine-regulators-ok-states-largest-renewables-solicitation-with-482-mw-sol/585735.*

Many Maine municipalities allow Property Assessed Clean Energy (PACE) financing whereby energy upgrades are paid off over an assigned term of years through an assessment on the homeowner's property tax bill.[6] In cases where PV is eligible, PACE can make it easier for LMI homeowners to purchase a solar installation even if they may want to sell their home before the system is fully paid off; the PACE assessment attaches to the property rather than to the homeowner.

Economics of a Typical PV System. This report's analysis of typical costs for a 4-kW system in Maine showed that very large financial incentives would be necessary to help LMI homeowners pay for the upfront costs of solar. Among the 14 target states, only Kentucky showed less favorable solar financials. Part of the reason for this is that Maine has a less robust solar resource than most states further south.

Solar Industry Perspectives. A survey was sent to solar installers in Maine to assess their experience with manufactured homes and to get their perceptions of the potential for solar energy for manufactured housing in their state. Researchers did not receive an adequate level of response to gauge a particular level of interest or experience in installing solar systems on manufactured homes. However, one response emphasized the prohibitive cost of solar installations for LMI manufactured home residents and the lack of state solar incentives in Maine.[7]

Utility Activities. Residential electricity service is dominated by two investor-owned utilities, Central Maine Power and Versant Power, although there are also two rural electric cooperatives and five municipal utilities.

RECOMMENDATIONS

To succeed, any solar initiative for manufactured housing would need new funding to make solar financially beneficial for the LMI residents. Because the Governor's Energy Office is already considering ways to use solar for the benefit of LMI households, it would make sense to make manufactured housing part of those deliberations. Perhaps the Office could support Solarize-style marketing campaigns aimed at LMI single-family homes and ensure that the selected locations include a significant number of manufactured homes in the housing stock.

Efficiency Maine, the state's consolidated energy efficiency and alternative energy program administrator, might be well positioned to facilitate program delivery for a solar program serving LMI manufactured homes.[8] PACE could also be a viable financing vehicle for solar for manufactured homes and should be explored further.

It would be good to explore possible opportunities for solar at the eight ROCs and 43 large communities to see whether any of them would be appropriate settings for a community-scale project or Solarize-style campaign. Given the research findings provided by this report about the income levels of census tracts, it would be important to ensure that the residents of any selected ROC or other community are indeed LMI.

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6 Efficiency Maine, List of PACE Municipalities, accessed September 24, 2020, *https://www.efficiencymaine.com/docs/List-of-PACE-municipalities1.pdf.*

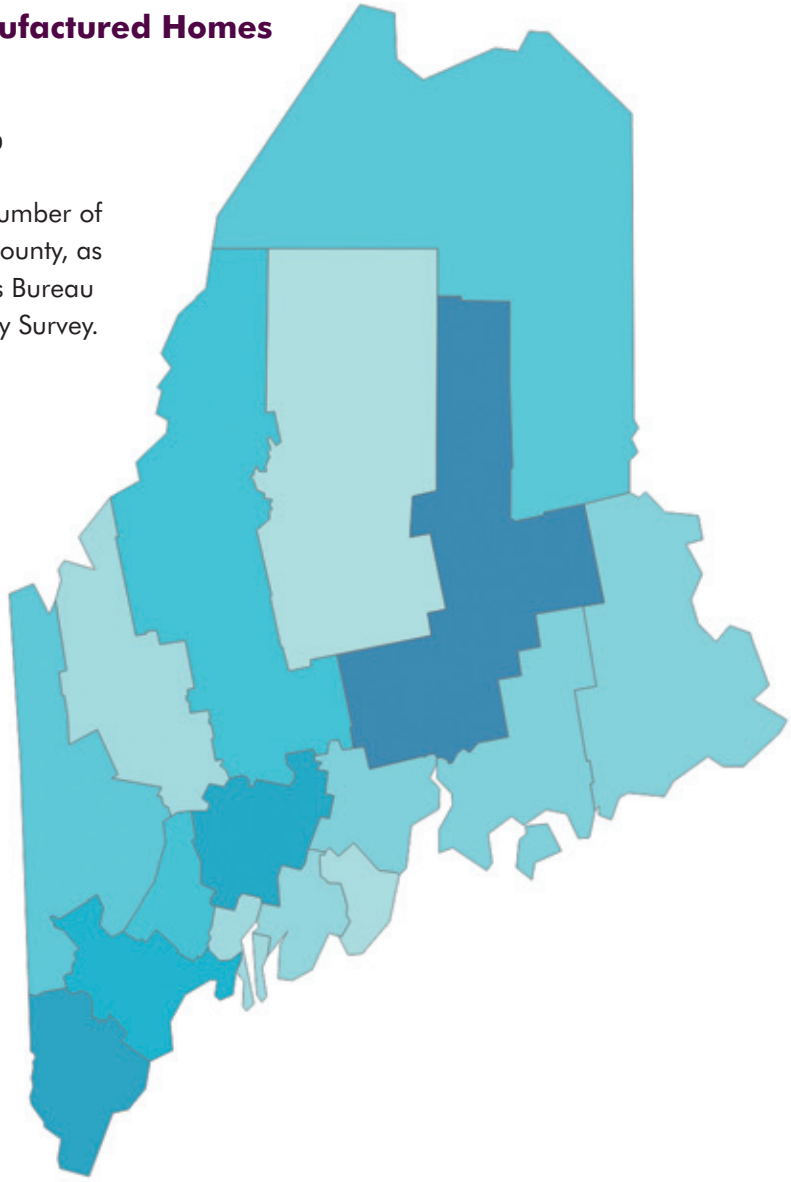
7 Greg Dorsey, Goggin Energy, Survey of Solar Installers in Texas, Survey Response, May 2020.

8 Governor's Energy Office, "Energy Efficiency and Renewable Energy" webpage, accessed September 24, 2020, *https://www.maine.gov/energy/initiatives/efficiency_renewable.html.*

With Central Maine Power's dominance in the state, the utility could be approached to explore whether it would consider supporting solar for manufactured home communities as a way to alleviate poverty and reduce delinquent bill payments.

THE GEOGRAPHY OF MAINE'S MANUFACTURED HOMES

FIGURE ME1: **Total Manufactured Homes**



This map shows the total number of manufactured homes per county, as estimated in the US Census Bureau 2019 American Community Survey.

FIGURE ME2: **Manufactured Homes vs. Household Income**

	Manufactured Homes		
Income	Low	Medium	High
Low			
Medium			
High			

This map includes two variables for each county: the percentage of the housing stock that is manufactured homes and the median household income. This shows the correlation between manufactured homes housing stock and areas with low incomes.

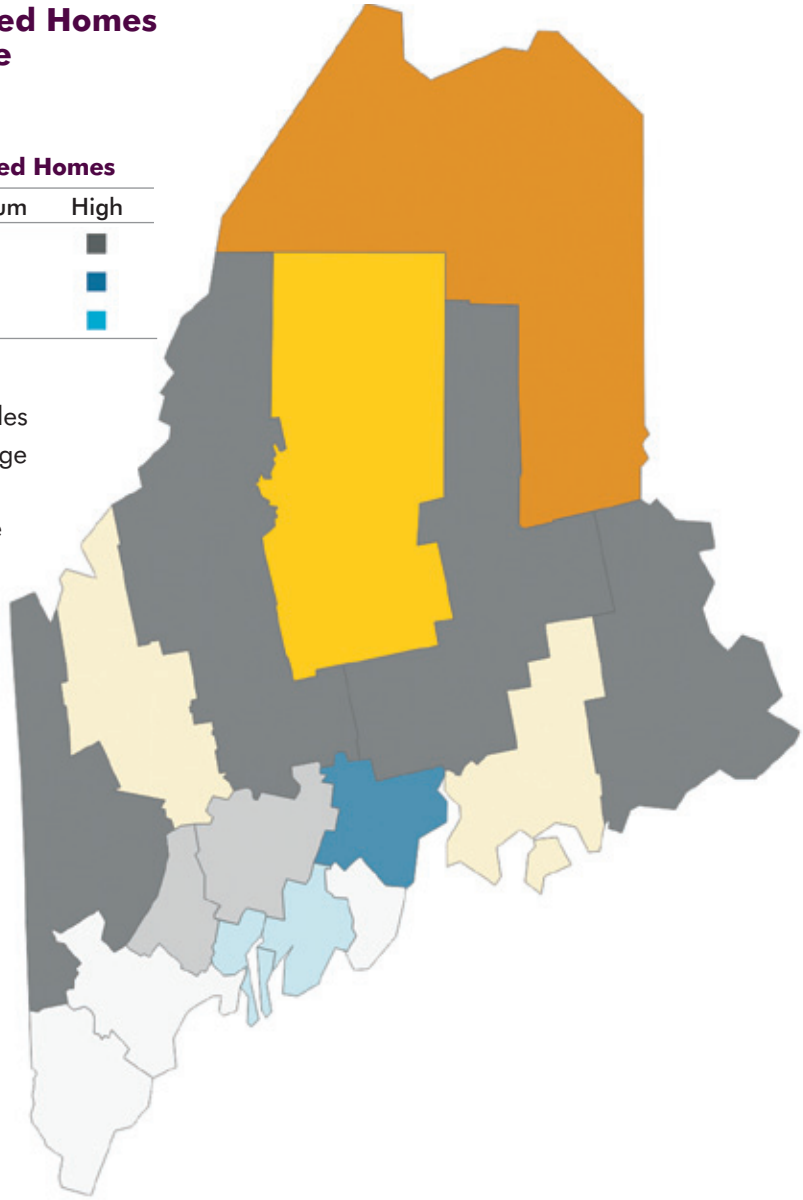


TABLE ME2: **Communities and Homesites by Utility**

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Atlantic City Electric Co.	1	0	0
Central Maine Power Co.	242	10,620	57
Eastern Maine Electric Coop.	3	0	0
Houlton Water Co.	3	51	0
Town of Madison, Maine (Utility Co.)	1	0	0
Versant Power–Bangor Power	56	1,912	10
Versant Powe–Maine Public Service Co.	15	378	0

DATA ABOUT MAINE'S MANUFACTURED HOME COMMUNITIES

Community Size

TABLE ME3: **Number of Mobile Home Communities by Size**

Category Range (sites in community)	Category Count	% of Total Communities with Site Counts
Large: >100	**43**	**31.16%**
>500	1	
300–499	8	
100–299	34	
Medium: 50–99	**31**	**22.46%**
75–99	5	
50–74	26	
Small: 1-49	**64**	**46.38%**
25–49	37	
1–24	27	
Communities without Site Counts	**189**	
Total Number of Communities	**327**	

TABLE ME4: **Homesites by Community Size**

Community Size	Sites	% of Sites
Large	9,368	71.05%
Medium	2,042	15.49%
Small	1,776	13.47%
Total Sites	**13,186**	**100%**

Community Income

1. State Median Household Income — $57,918

TABLE ME5: **Communities in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
Community Count	64	25	113	59
Site Count	5,026	1,570	3,976	1,243
% of Sites	38.12%	11.91%	30.15%	9.43%
% of Total Communities	29.49%	11.52%	52.07%	27.19%

TABLE ME6: **Income by Community Size**

		Small	Medium	Large
LMI Communities (by CBSA)	Community Count	7	4	16
	Site Count	150	241	4,635
	% of Sites	10.94%	12.90%	37.21%
	% of Total Communities	5.07%	2.90%	11.59%
Low-Income Communities (by CBSA)	Community Count	2	0	6
	Site Count	33	0	1,537
	% of Sites	3.13%	0.00%	13.95%
	% of Total Communities	1.45%	0.00%	4.35%

2. Communities Restricted to Ages 55+

TABLE ME7: **Total Number of Communities with Age Restrictions**

Number of Age-Restricted Communities	Sites	Percent of All Communities	Percent of All Sites
23	1,893	7.03%	14.36%

TABLE ME8: **Age-Restricted Communities in LMI Census Tracts (by CBSA)**

	Small	Medium	Large
Total Number	**11**	**7**	**5**
LMI Communities	2	2	1
% of Age-Restricted Communities	8.70%	8.70%	4.35%
Low-income	**0**	**0**	**1**
% Age-Restricted Communities	0.00%	0.00%	4.35%

Michigan

THE STATE'S MANUFACTURED HOUSING STOCK

Michigan has 242,393 manufactured homes, according to the US Census Bureau, representing 5.3 percent of the state's housing stock. What is most notable is that a higher percentage of the homes are located in manufactured home communities than for any of the other target states. There is also an unusually high number of large communities.

The Datacomp database for Michigan includes 1,209 communities and 182,868 identified homesites. Those homesites represent 75.5 percent of the sites in the US Census Bureau's count. Likely because Datacomp's headquarters are in Michigan, the database seems to be more complete than for other states. Only 14.8 percent of the communities are missing homesite counts. An overwhelming proportion of manufactured homes in the state are sited in manufactured home communities rather than on individually owned plots of land.

The majority of communities with site counts (574) have more than 100 homesites, and 64 communities have more than 500 homesites. As a result, 87.0 percent of identified homesites are in large communities with over 100 homesites.

An above-average share of communities (7.4 percent) is restricted to residents older than 55. There are 89 such communities.

Most communities are in LMI census tracts when compared to the state median income ($57,144), but fewer are when compared to the median household income of the local core-based statistical area (CBSA). This emphasizes that a disproportionate share of the communities is in parts of the state with below-average area incomes (see maps at the end of this section). The age-restricted communities are less likely to be in LMI census tracts than non-restricted communities.

Manufactured housing has been a significant share of the new homes in the state in recent years. In 2019, 4,203 manufactured homes were shipped to market, compared to 14,623 building permits issued in that same year for site-built, single-family homes.[1]

Most of the manufactured home communities and sites are in the service territory of two large investor-owned utilities—Consumers Energy and DTE Electric. But there are also many communities in the service territories of smaller investor-owned utilities and in some of Michigan's 11 rural electric cooperatives and 40 municipal utilities. For example, Great Lakes Energy

1 US Census Bureau, "U.S. Manufactured Housing Shipments by State: 2019," *https://www2.census.gov/programs-surveys/mhs/visualizations/2019/2019usmapbystate.pdf*; US Census Bureau, "Building Permits Survey Annual Data," *https://www.census.gov/construction/bps/stateannual.html*.

TABLE MI1: **Michigan Communities and Sites in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
% of Sites	43.95%	15.69%	51.17%	21.90%
% of Total Communities	42.19%	18.46%	62.38%	33.05%

Coop has 149 manufactured home communities and 15,925 sites, while Midwest Energy Coop has 89 communities and 7,835 sites.

THE STATE'S SOLAR LANDSCAPE

Michigan has not been one of the more active states for solar development, but the pace has been picking up in recent years. Overall solar capacity is ranked 34th in the nation, but the state was 26th in the amount of capacity added in 2020.[2]

Economics of a Typical PV System. The analysis undertaken for this project of typical costs for a 4-kW system suggests that the economics of PV are less favorable than in most of the 14 target states. However, a primary reason for this is the state's current higher-than-average solar installation costs. Costs will likely fall as the market expands, creating competition and increasing economies of scale.

State Policies and Programs. Since taking office in January 2019, Governor Gretchen Whitmer has been a strong proponent of clean energy. Among other things, she created an Office of Climate and Energy to ensure that climate change is considered in the development of new policies. She also appointed members to the state's first Advisory Council for Environmental Justice that will explore the challenges facing low-income households to access clean energy opportunities.[3] The relatively high cost of electricity (11th highest in the US) also creates some traction for solar. Michigan allows third-party ownership of residential PV systems.

In 2016, the Michigan legislature passed legislation directing the Michigan Public Service Commission (PSC) to phase out net metering and replace it with a successor compensation methodology. In 2019, the PSC eliminated full retail net metering for customers of DTE, the largest electric utility in the state, and moved instead to credit solar customers at the "power supply component" of the retail rate minus transmission charges. This means that DTE's solar customers will now be credited for solar power sent to the grid at a rate between the full retail rate previously offered for net metering and DTE's proposed average monthly wholesale electricity rate.[4]

There has been considerable interest in community solar in Michigan and that could be a promising approach for LMI solar. Although Michigan does not have a statewide community

2 Solar Energy Industries Association, "Michigan Solar" webpage, accessed March 22, 2021, *https://www.seia.org/state-solar-policy/michigan-solar*.

3 Energy News Network, "Michigan Environmental Justice Council to Take on Energy Access and Pollution," February 10, 2020, accessed September 24, 2020, *https://energynews.us/2020/02/10/midwest/michigan-environmental-justice-council-to-take-on-energy-access-and-pollution*.

4 PV Magazine, "DTE Finally Kills Net Metering," May 2, 2019, accessed September 24, 2020, *https://pv-magazine-usa.com/2019/05/02/dte-finally-kills-net-metering*.

shared-solar program, the Michigan Department of Environment, Great Lakes, and Energy (EGLE) has a Michigan Clean Energy for Low-Income Community Access (Mi-CELICA) program that works with different types of utilities and other agencies to create low-income community solar projects. They have been creative in finding partners and funding sources for these projects. The goal is to create models that can be replicated in other communities and to identify best practices based on each utility type (municipal, cooperative, investor-owned). The department's Mi-CELICA program won a CESA "State Leadership in Clean Energy Award" in 2020.[5]

In the case of the community solar project with Cherryland Electric Cooperative in northwestern Michigan, Mi-CELICA Phase I—Cooperative Utility, members could purchase a portion of panels in a shared solar array and receive credits on their monthly electricity bills. Members who participate are saving $20–$30 monthly. In Mi-CELICA Phase II—Municipal Utility, the participants located in the upper peninsula Village of L'Anse enrolled in an on-bill financing program that allowed them to receive solar credits. The subscribers of that program are seeing a credit of $21-$23 per month on their electricity bills. The Mi-CELICA Phase III—Investor-Owned Utility is slated to begin in spring 2021.

Utility Programs. Cherryland Electric Cooperative is promoting solar in other ways. In addition to the community solar option, it offers net metering for those who want to offset their energy usage with their own electric generation, as well as a "buy-all sell-all" program for members to sell all the electricity their solar system produces to the electric cooperative while generating enough energy to cover their entire annual electricity usage.[6] These same three solar programs are available in Thumb Electric Cooperative in the "thumb" region, Great Lakes Energy Cooperative in the northern part of the Lower Peninsula, and HomeWorks Tri-County Electric Cooperative in central Michigan.

RECOMMENDATIONS

To succeed, any solar initiative for manufactured housing would need new funding to make solar financially beneficial for the LMI residents. Focusing on third-party ownership would likely be most cost-effective.

Given EGLE's existing interest in community solar, it would make sense to focus on expanding that model. The many large manufactured home communities in Michigan represent a logical target for recruiting community solar customers, and they might have land that would be suitable for projects.

Those same large communities could provide opportunities for initiatives other than community solar. There could be efficiencies by implementing marketing campaigns aimed at one or more large communities where there are community members' associations and mechanisms for disseminating news. A Solarize-style campaign could work well in such a setting by seeking to offer a large number of identical rooftop, ground-mounted, or pole-mounted systems.

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5 For a case study of the EGLE program, see Maria Blais Costello, State Leadership in Clean Energy 2020 Awards: Case Studies of Award-Winning Programs that Are Accelerating the Clean Energy Transition (CESA, July 2020), pp. 17–20, *https://www.cesa.org/wp-content/uploads/2020SLICE.pdf.*

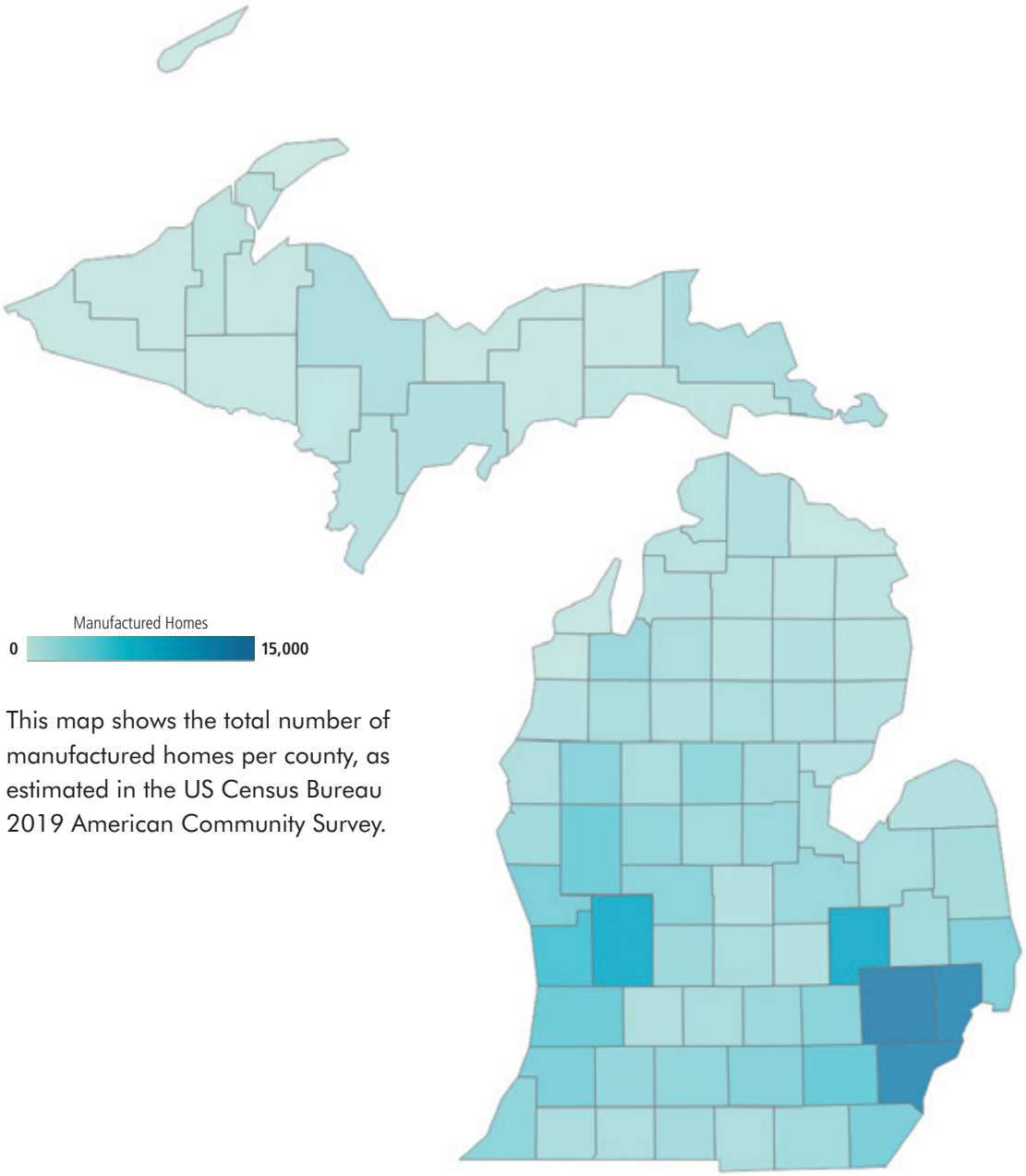
6 Cherryland Electric Cooperative. Renewable Energy Programs webpage, *https://www.cherrylandelectric.coop/renewable-energy-programs.*

From its previous and current efforts, EGLE should have some sense of which utilities might want to be partners and might be interested in efforts to alleviate poverty and reduce delinquent bill payments.

The market for new manufactured homes is sufficiently robust in Michigan that it would be desirable to undertake efforts to ensure that house purchasers have an option to buy a solar-ready manufactured home and to purchase a rooftop system that can be included as part of the financing for the home.

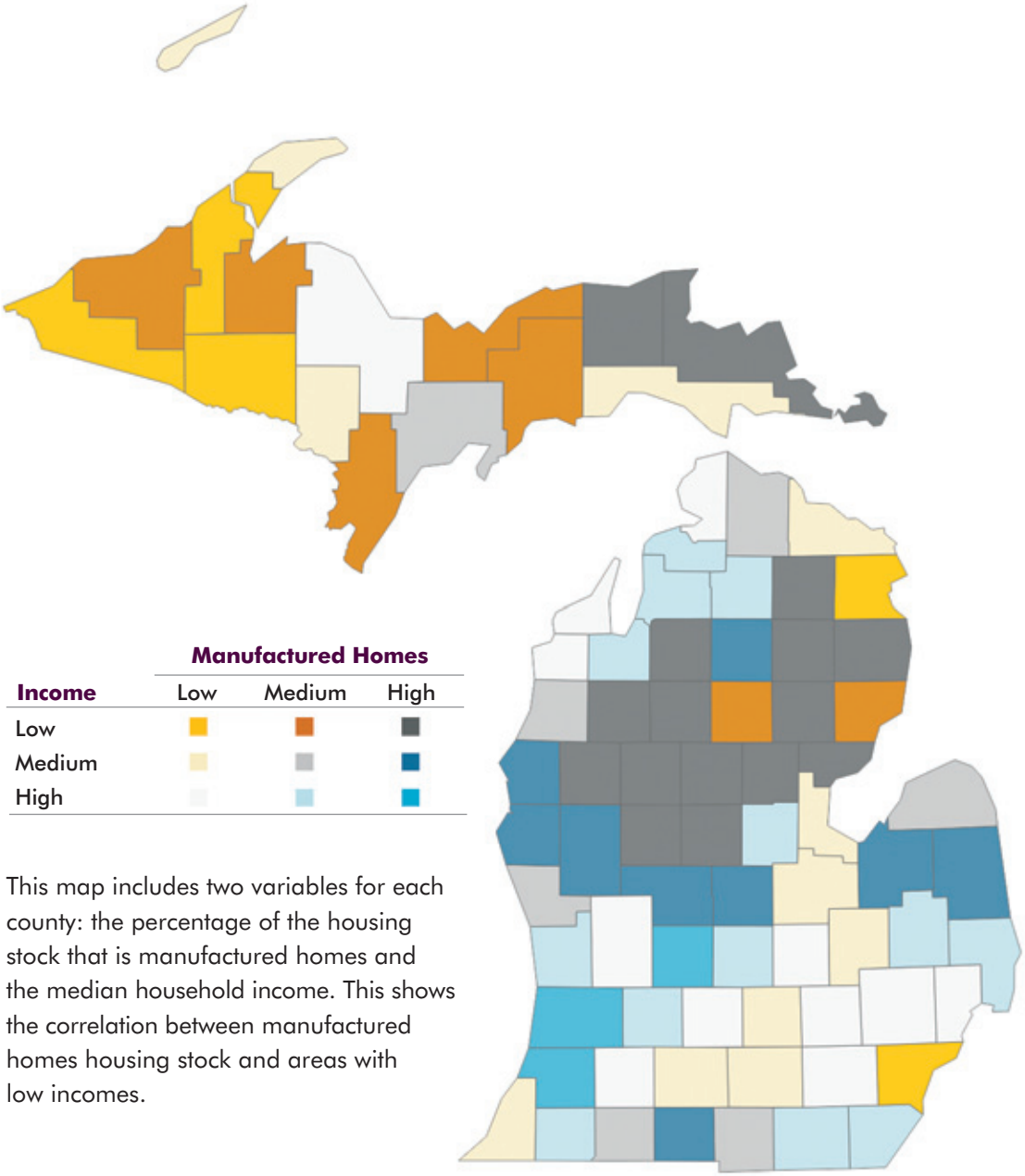
THE GEOGRAPHY OF MICHIGAN'S MANUFACTURED HOMES

FIGURE MI1: **Total Manufactured Homes**



This map shows the total number of manufactured homes per county, as estimated in the US Census Bureau 2019 American Community Survey.

FIGURE MI2: **Manufactured Homes vs. Household Income**



	Manufactured Homes		
Income	Low	Medium	High
Low			
Medium			
High			

This map includes two variables for each county: the percentage of the housing stock that is manufactured homes and the median household income. This shows the correlation between manufactured homes housing stock and areas with low incomes.

TABLE MI2: **Communities and Homesites by Utility**

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Alger-Delta Coop Electric Association	6	341	0
Alpena Power Co.	9	108	0
Bayfield Electric Coop., Inc.	3	0	0
Cherryland Electric Coop. Inc.	17	2,243	5
City of Bay City, Michigan (Utility Co.)	1	1	1
City of Charlevoix, Michigan (Utility Co.)	1	35	0
City of Eaton Rapids, Michigan (Utility Co.)	1	27	1
City of Escanaba, Michigan (Utility Co.)	2	227	2
City of Gladstone, Michigan (Utility Co.)	2	175	0
City of Lansing, Michigan (Utility Co.)	7	919	5
City of Lowell, Michigan (Utility Co.)	2	138	0
City of Marshall, Michigan (Utility Co.)	1	21	0
City of Portland, Michigan (Utility Co.)	1	35	0
City of South Haven, Michigan (Utility Co.)	3	254	0
City of St Louis, Michigan (Utility Co.)	1	183	1
City of Traverse City, Michigan (Utility Co.)	1	192	1
City of Wakefield, Michigan (Utility Co.)	1	0	0
Cloverland Electric Coop.	7	519	5
Coldwater Board of Public Utility	3	454	3
Consumers Energy Co.	753	99,140	262
DTE Electric	327	73,762	164
Great Lakes Energy Coop.	143	15,925	37
Indiana Michigan Power Co.	107	10,335	36
Midwest Energy Coop.	89	7835	32
Northern States Power Co.	3	3	0
Ontonagon County REA	2	41	0
Presque Isle Electric & Gas Coop.	14	234	0
Thumb Electric Coop. of Michigan	36	2,080	0
Tri-County Electric Membership Corp.	63	5,598	19
Upper Peninsula Power Co.	19	786	2
Village of Clinton, Michigan (Utility Co.)	6	3,256	5
Village of L'Anse, Michigan (Utility Co.)	1	40	0
Westar Energy, Inc.	1	60	0
Wisconsin Electric Power Co.	9	593	2
Wisconsin Public Service Corp.	2	172	1

DATA ABOUT MICHIGAN'S MANUFACTURED HOME COMMUNITIES

Community Size

TABLE MI3: **Number of Manufactured Home Communities by Size**

Category Range (sites in community)	Category Count	% of Total Communities with Site Counts
Large: >100	**574**	**55.67%**
>500	64	
300–499	117	
100–299	393	
Medium: 50–99	**252**	**24.44%**
75–99	101	
50–74	151	
Small: 1-49	**205**	**19.88%**
25–49	132	
1–24	73	
Communities without Site Counts	**178**	
Total Number of Communities	**1,209**	

TABLE MI4: **Homesites by Community Size**

Community Size	Sites	% of Sites
Large	159,048	86.97%
Medium	17,761	9.71%
Small	6,059	3.31%
Total Sites	**182,868**	**100%**

Community Income

1. State Median Household Income — $57,144

TABLE MI5: **Communities in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
Community Count	489	214	723	383
Site Count	80,377	28,694	93,579	40,054
% of Sites	43.95%	15.69%	51.17%	21.90%
% of Total Communities	42.19%	18.46%	62.38%	33.05%

TABLE MI6: **Income by Community Size**

		Small	Medium	Large
LMI Communities (by CBSA)	Community Count	67	88	267
	Site Count	1,906	6,214	76,310
	% of Sites	32.68%	34.92%	46.52%
	% of Total Communities	6.50%	8.54%	25.90%
Low-Income Communities (by CBSA)	Community Count	22	41	117
	Site Count	591	2,929	29,786
	% of Sites	10.73%	16.27%	20.38%
	% of Total Communities	2.13%	3.98%	11.35%

2. Communities Restricted to Ages 55+

TABLE MI7: **Total Number of Communities with Age Restrictions**

Number of Age-Restricted Communities	Sites	Percent of All Communities	Percent of All Sites
89	10,821	7.36%	5.92%

TABLE MI8: **Age-Restricted Communities in LMI Census Tracts (by CBSA)**

	Small	Medium	Large
Total Number	**25**	**27**	**36**
LMI Communities	10	9	12
% of Age-Restricted Communities	11.24%	10.11%	13.48%
Low-income	**4**	**5**	**7**
% Age-Restricted Communities	4.49%	5.62%	7.87%

Missouri

THE STATE'S MANUFACTURED HOUSING STOCK

Missouri has 172,734 manufactured homes, according to the US Census Bureau, representing 6.2 percent of the state's housing stock. Most of these homes are located on privately owned individual plots of land rather than in manufactured home communities.

The Datacomp database has identified 675 manufactured home communities with 40,712 homesites, which accounts for 23.5 percent as many houses as in the Census Bureau's count. The database is missing site counts for only 89 communities, so it is likely reasonably complete.

Most of the communities with site counts are small. But because the large communities, by definition, have more homesites, most homesites (59.6 percent) are in the 129 large communities with over 100 homesites. Only three communities have more than 500 homesites. Relatively few communities (22) are age restricted.

Compared to most of the other target states, a smaller percentage of the communities and homesites in the Datacomp database are in a census tract that is low-income or low-to-moderate income (LMI) compared to the median household income of its core-based statistical area (CBSA). The share of communities that are in LMI census tracts is higher when compared to the state median household income of $55,461, but the percentage of LMI and low-income homesites remains small compared to the state median. There are several possible explanations for this, but it is likely that more community residents have above-average incomes than in other states, especially when compared to the CBSA.

The new homes construction market has not recently been as active in Missouri as in some other states. Manufactured homes have only been a small percentage of that market. In 2019, 1,291 manufactured homes were shipped to market, compared to 10,955 building permits issued for site-built, single-family homes.[1]

The largest share of manufactured home communities (293 with 22,813 homesites) is in the service territory of investor-owned utility Ameren. But there are many utilities in the state and the manufactured home communities and homesites are distributed widely.

1 US Census Bureau, "U.S. Manufactured Housing Shipments by State: 2019," *https://www2.census.gov/programs-surveys/mhs/visualizations/2019/2019usmapbystate.pdf*; US Census Bureau, "Building Permits Survey Annual Data," *https://www.census.gov/construction/bps/stateannual.html*.

TABLE MO1: **Missouri Communities and Sites in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
% of Sites	47.14%	18.78%	47.99%	20.86%
% of Total Communities	47.03%	19.97%	65.02%	32.18%

THE STATE'S SOLAR LANDSCAPE

Solar development in Missouri has been increasing slowly but steadily. While the state ranks 18th in population, it is 33rd in solar capacity and ranked 37th in new capacity installed in 2020. Much of that increase was due to residential installations.[2] Relatively low retail electricity prices (16th lowest in the nation) make it more difficult for residential solar to provide costs savings than in many states.

Economics of a Typical PV System. The analysis undertaken for this project of typical costs for a 4-kW system suggests that the economics of PV are more favorable than in some states, but significant new financial incentives would be necessary to help LMI homeowners pay for the upfront costs. Because third-party ownership of residential systems is not permitted, it could be difficult to come up with strategies for doing that.

State Policies. Missouri's net metering policy requires all utilities to offer net metering to customers with solar systems up to 100 kilowatts (kW). Customers are not paid the full retail price for surplus energy and they are instead credited at the utility's avoided cost rate. Credit that is not used after twelve months reverts back to the utility and the customer receives no compensation.

Utility Programs and Perspectives. Many of the state's largest utilities offer rebates for homeowners who install solar systems. In addition, Missouri's largest electric utility, Ameren, and two other investor-owned utilities are developing an on-bill financing program referred to as Pay as You Save (PAYS). State regulators required them to hire consultants to evaluate a potential on-bill program. Pilot programs are scheduled to take place in 2022 and are targeted at financing energy efficiency upgrades that are most likely to ensure enough energy savings to pay for the upgrades. The PAYS program requires no credit check and the line-item charge on the customer's bill stays with the property and falls to the current occupant or owner who pays the electricity bill.[3] There could potentially be opportunities to use this financing for solar.

Missouri has an unusually large number of rural electric cooperatives and municipal utilities. The 47 coops rank the state as second in the nation, while the 86 municipal utilities rank first. Some of those utilities have taken steps to promote solar. For example, Platte-Clay Electric Cooperative learned of its members' interest in solar from surveys it sent to solicit input. In 2015, it became one of the first 100 rural electric cooperatives in the US—and the first in

2 Solar Energy Industries Association, "Missouri Solar" webpage, accessed March 22, 2021, *https://www.seia.org/state-solar-policy/missouri-solar.*

3 Karen Uhlenhuth, "Missouri Utilities Moving Ahead with On-Bill Energy Efficiency Financing," Energy News Network, May 2020, *https://energynews.us/2020/05/29/midwest/missouri-utilities-moving-ahead-with-on-bill-energy-efficiency-financing.*

Missouri—to build a community solar array. A 100-kW array was installed adjacent to Platte-Clay's headquarters in Kearney, north of Kansas City.[4]

Boone Electric Cooperative offers members the option to purchase 100 kilowatt-hour (kWh) blocks of solar energy. In 2016, Boone completed a community solar array in partnership with a tax equity investor, to share the costs of the new facility and offer solar energy at a reasonable cost to its members. On average, the monthly premium added to a member participating in the community solar array per panel ranges seasonally between $1.54 and $3.35, with no contract commitment or upfront costs, and the ability to cancel at any time without penalty.[5] Both Boone Electric Cooperative and Platte-Clay Electric Cooperative have a significant number of manufactured home communities and homesites in their service territory.

RECOMMENDATIONS

Any solar initiative for manufactured housing would need new funding to make solar financially beneficial for the LMI residents. The most logical starting point would be a modest pilot initiative that could be offered in one or a few locations. The key to offering such an initiative would be finding willing partners able to provide some funding. With so many utilities in the state, there should be an exploration to see if any might be interested in taking part in a pilot. It might also be possible to recruit a philanthropic foundation or other community-based organization that seeks to improve the lives of Missouri's low-income households.

One specific near-term action would be to see if solar can be included in the PAYS programs being developed by investor-owned utilities. This could help address the hurdle of providing financing to cover the upfront cost of a system. It would also be good to see if there might be support for allowing third-party ownership of residential PV.

If a funding mechanism for LMI solar is found, a pilot project or initiative could take one of several forms. There are enough large manufactured home communities that one or more of them could be the focus of a pilot. A marketing campaign could be efficient if it used the community's homeowners association and other mechanisms for disseminating information within the community. A Solarize-style campaign could work well in such a setting—either seeking to offer a large number of identical rooftop, ground-mounted, or pole-mounted systems or seeking subscribers to a shared community solar project.

Alternatively, an initiative could focus on the larger number of manufactured homes that are not in communities. In that case, the best strategy could be a Solarize-type campaign aimed at all LMI single-family homes in a specific geographic area, not just manufactured homes. If the goal is to bring solar to LMI homeowners, there would not be a reason to exclude LMI houses that are not manufactured homes. But the technology solutions offered would need to work with both manufactured homes and site-built homes. However, it could be sales of manufactured homes are not a sufficiently large portion of the new home market to justify making that market a major focus of state or utility programs to advance solar.

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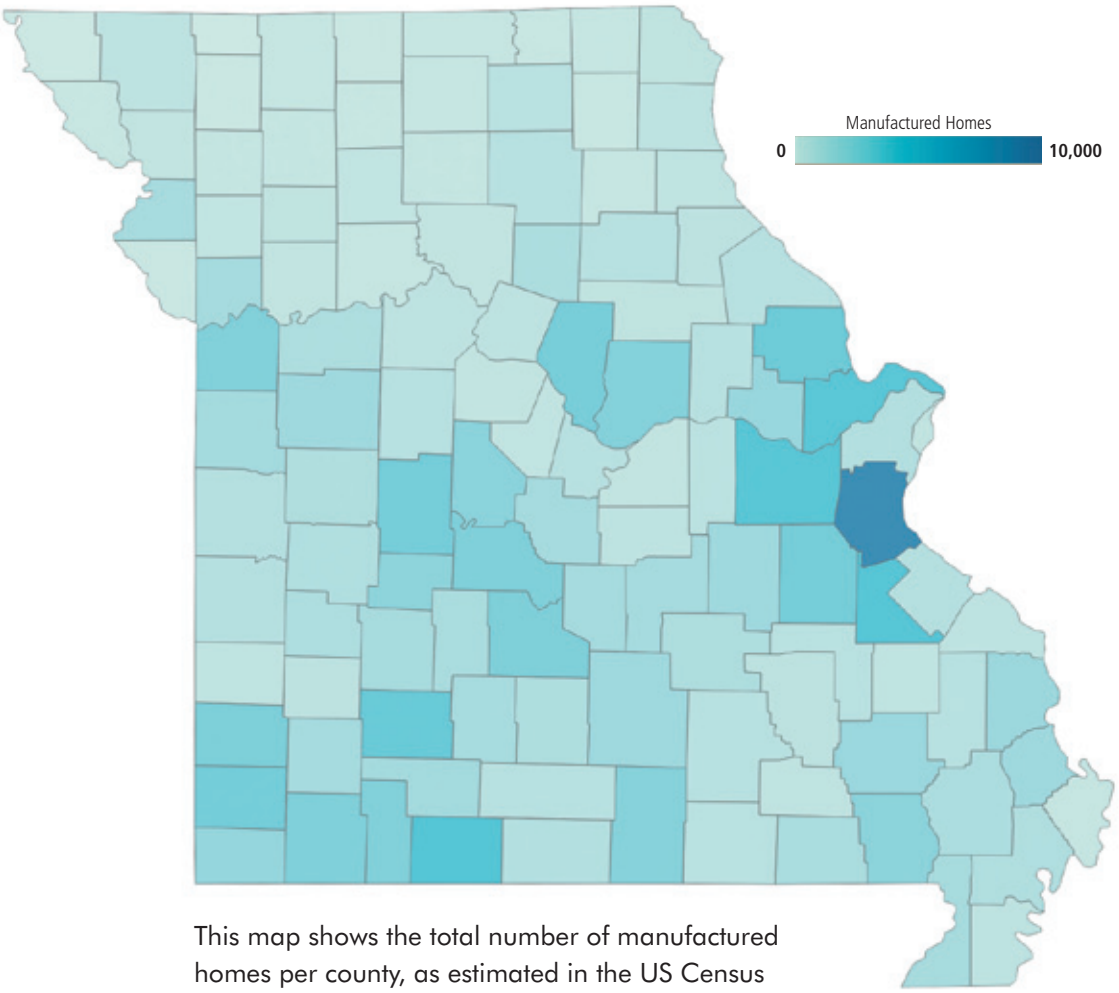
4 Platte-Clay Electric Cooperative, "PCEC Solar Energy" webpage, *https://www.pcec.coop/energy/pcec-solar-energy*; see also, Karen Uhlenhuth, "Missouri Co-op to be First in State to Launch Community Solar," Energy News Network, February 2015, *https://energynews.us/2015/02/03/midwest/missouri-co-op-to-be-first-in-state-to-launch-community-solar.*

5 Boone Electric Cooperative, "Renewable Energy" webpage, *https://www.booneelectric.coop/renewable-energy.*

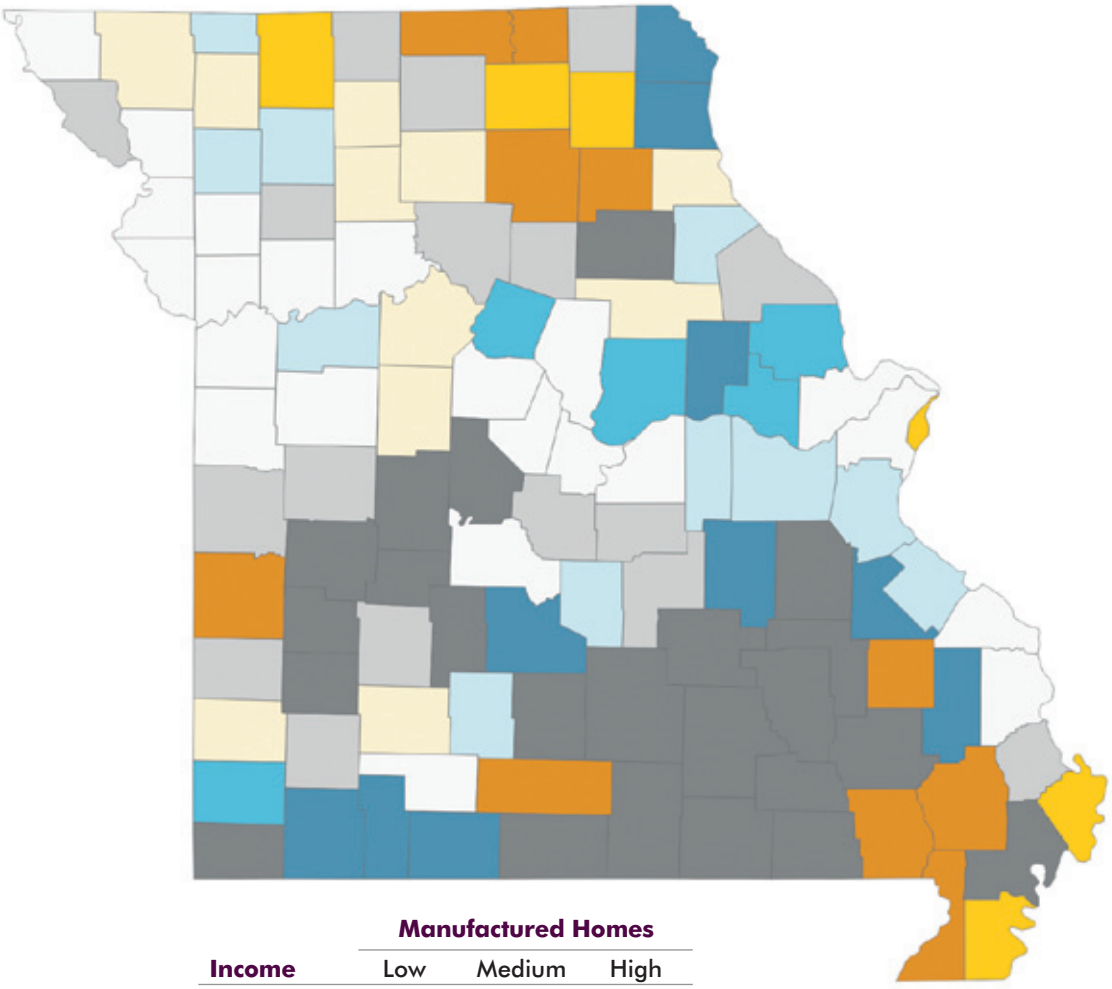
THE GEOGRAPHY OF MISSOURI'S MANUFACTURED HOMES

FIGURE MO1: **Total Manufactured Homes**



This map shows the total number of manufactured homes per county, as estimated in the US Census Bureau 2019 American Community Survey.

FIGURE MO2: **Manufactured Homes vs. Household Income**



	Manufactured Homes		
Income	Low	Medium	High
Low			
Medium			
High			

This map includes two variables for each county: the percentage of the housing stock that is manufactured homes and the median household income. This shows the correlation between manufactured homes housing stock and areas with low incomes.

TABLE MO2: **Communities and Homesites by Utility**

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Ameren	293	22,813	140
Barry Electric Coop.	1	20	0
Barton County Elec Coop., Inc.	2	32	1
Black River Electric Coop.	4	161	1
Boone Electric Coop.	26	1,621	10
Callaway Electric Coop.	4	317	2
Carroll Electric Coop. Corp.	3	27	0
Central Missouri Elec Coop., Inc.	1	16	0
Chillicothe Municipal Utilities	2	7	0
Citizens Electric Corp.	13	445	0
City of California, Missouri (Utility Co.)	1	18	1
City of Columbia, Missouri (Utility Co.)	1	193	0
City of Cuba, Missouri (Utility C.)	2	54	0
City of El Dorado Springs, Missouri (Utility Co.)	1	100	0
City of Farmington, Missouri (Utility Co.)	2	145	0
City of Fayette, Missouri (Utility Co.)	2	17	2
City of Hannibal, Missouri (Utility Co.)	1	35	1
City of Harrisonville, Missouri (Utility Co.)	3	128	2
City of Hermann, Missouri (Utility Co.)	1	24	0
City of Higginsville, Missouri (Utility Co.)	1	33	1
City of Independence, Missouri (Utility Co.)	11	1,554	10
City of Kahoka, Missouri (Utility Co.)	1	1	1
City of Kansas City, Kansas (Utility Co.)	1	1	0
City of La Plata, Missouri (Utility Co.)	1	23	0
City of Monett, Missouri (Utility C.)	1	22	0
City of Monroe City, Missouri (Utility Co.)	2	74	0
City of New Madrid, Missouri (Utility Co.)	1	51	0
City of Odessa, Missouri (Utility Company)	2	44	1
City of Osceola, Missouri (Utility Company)	1	23	0
City of Owensville, Missouri (Utility Co.)	1	20	0
City of Palmyra, Missouri (Utility Co.)	1	13	1
City of Paris, Missouri (Utility Co.)	1	58	0
City of Poplar Bluff, Missouri (Utility Co.)	1	26	0
City of Richland, Missouri (Utility Co.)	1	30	0
City of Rolla, Missouri (Utility Co.)	1	17	1

TABLE MO2: **Communities and Homesites by Utility** (CONTINUED)

Utility	Total Communities	Total Sites	LMI Communities by CBSA
City of Shelbina, Missouri (Utility Co.)	1	10	0
City of St Robert, Missouri (Utility Co.)	5	76	0
City of Sullivan, Missouri (Utility Co.)	1	31	1
City of Unionville, Missouri (Utility Co.)	1	5	0
City of Waynesville, Missouri (Utility Co.)	1	1	1
City of West Plains, Missouri (Utility Co.)	1	20	1
City of Willow Springs, Missouri (Utility Co.)	1	20	0
City Utilities of Springfield	27	1,602	18
Co-Mo Electric Coop., Inc.	8	122	1
Consolidated Electric Coop.	4	195	1
Crawford Electric Coop., Inc.	49	4,129	23
Cuivre River Electric Coop., Inc.	18	2,186	1
Eastern Iowa Light & Power Coop.	1	14	0
Empire District Electric Co.	44	1,643	11
Farmers Rural Electric Coop. Corp.	2	79	2
Gascosage Electric Coop.	2	50	1
Grundy Electric Coop., Inc.	1	5	0
Grundy Electric Coop., Inc. (Iowa)	1	5	0
Howell-Oregon Electric Coop., Inc.	4	151	3
Intercounty Electric Coop. Association	13	323	5
Kansas City Power & Light Co.	23	2,319	20
KCP&L Greater Missouri Operations	66	3,629	34
Laclede Electric Coop., Inc.	28	618	6
Macon Electric Coop.	3	100	0
Missouri Rural Electric Coop.	2	82	2
New-Mac Electric Coop., Inc.	3	189	0
Northeast Oklahoma Electric Coop., Inc.	1	1	0
Osage Valley Elec Coop. Association	1	14	0
Ozark Border Electric Coop.	2	53	1
Ozark Electric Coop., Inc	6	530	1
Platte-Clay Electric Coop, Inc.	6	654	2
Ralls County Electric Coop.	1	13	0
SE-MA-NO Electric Coop.	4	97	0
SEMO Electric Coop.	2	38	0
Southwest Electric Coop., Inc.	15	454	2

TABLE MO2: **Communities and Homesites by Utility** (CONTINUED)

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Southwestern Electric Power Co.	1	1	0
Three Rivers Electric Coop.	10	325	5
Tri-County Electric Member Corp.	1	60	0
Webster Electric Coop.	10	716	3
West Central Electric Coop., Inc.	8	388	7
White River Valley Electric Coop., Inc.	21	865	10

DATA ABOUT MISSOURI'S MANUFACTURED HOME COMMUNITIES

Community Size

TABLE MO3: **Number of Manufactured Home Communities by Size**

Category Range (sites in community)	Category Count	% of Total Communities with Site Counts
Large: >100	**129**	**22.01%**
>500	3	
300–499	14	
100–299	112	
Medium: 50–99	**124**	**21.16%**
75–99	39	
50–74	85	
Small: 1-49	**333**	**56.83%**
25–49	155	
1–24	178	
Communities without Site Counts	**89**	
Total Number of Communities	**675**	

TABLE MO4: **Homesites by Community Size**

Community Size	Sites	% of Sites
Large	24,263	59.60%
Medium	8,433	20.71%
Small	8,016	19.69%
Total Sites	**40,712**	**100%**

Community Income

1. State Median Household Income — $55,461

TABLE MO5: **Communities in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
Community Count	285	121	394	195
Site Count	19,190	7,644	19,539	8,491
% of Sites	47.14%	18.78%	47.99%	20.86%
% of Total Communities	47.03%	19.97%	65.02%	32.18%

TABLE MO6: **Income by Community Size**

		Small	Medium	Large
LMI Communities (by CBSA)	Community Count	138	47	63
	Site Count	3,556	3,314	12,320
	% of Sites	41.44%	37.90%	48.84%
	% of Total Communities	23.55%	8.02%	10.75%
Low-Income Communities (by CBSA)	Community Count	59	18	27
	Site Count	1,642	1,241	4,761
	% of Sites	17.72%	14.52%	20.93%
	% of Total Communities	10.07%	3.07%	4.61

2. Communities Restricted to Ages 55+

TABLE MO7: **Total Number of Communities with Age Restrictions**

Number of Age-Restricted Communities	Sites	Percent of All Communities	Percent of All Sites
22	1,560	3.26%	3.83%

TABLE MO8: **Age-Restricted Communities in LMI Census Tracts (by CBSA)**

	Small	Medium	Large
Total Number	**4**	**12**	**3**
LMI Communities	1	7	1
% of Age-Restricted Communities	4.55%	31.82%	4.55%
Low-income	**0**	**3**	**1**
% Age-Restricted Communities	0.00%	13.64%	4.55%

New Mexico

THE STATE'S MANUFACTURED HOUSING STOCK

New Mexico has the lowest median household income of the 14 target states and has a high rate of poverty. The 160,303 manufactured homes in the state, according to the US Census Bureau, represent 17 percent of the housing stock, the most for any state. Because of the high market penetration of manufactured housing, a high percentage of all LMI residents in the state live in such housing. Most of these homes are located on privately owned individual plots of land rather than in manufactured home communities.

The Datacomp database has identified 362 manufactured home communities with 24,110 homesites, which account for 15.2 percent as many houses as in the Census Bureau's counts. The database is missing site counts for 133 communities, but it is certain that the vast majority of manufactured homes in New Mexico are located outside of manufactured home communities. Some are in informal subdivisions, as described in Chapter 2 of Volume 1.

There are more small manufactured home communities than any other size. But because the large communities, by definition, have more homesites, most homesites (70.41 percent) are in the 68 large communities with over 100 homesites. Six communities have more than 500 homesites. Relatively few communities (26) are age restricted.

More than half the communities and homesites in the Datacomp database are in an LMI census tract, whether measured against the household income of its core-based statistical area (CBSA) or the state median household income. Large communities are more likely to be in LMI census tracts than smaller communities.

The new home construction market is not as active in New Mexico as in most other states, but manufactured housing has been a significant share of it. In 2019, 1,406 manufactured homes were shipped to market, compared to 4,285 building permits issued in that same year for site-built, single-family homes.[1] In other words, manufactured housing represented 24.7 percent of new single-family homes.

The manufactured home communities and homesites are spread across the service territories of several utilities. The largest group (142 communities and 10,498 homesites) are in the service territory of investor-owned utility Public Service Company of New Mexico. Six other utilities have communities that total at least 1,000 homesites.

1 US Census Bureau, "U.S. Manufactured Housing Shipments by State: 2019," *https://www2.census.gov/programs-surveys/mhs/visualizations/2019/2019usmapbystate.pdf*; US Census Bureau, "Building Permits Survey Annual Data," *https://www.census.gov/construction/bps/stateannual.html*.

TABLE NM1: **New Mexico Communities and Sites in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
% of Sites	55.06%	26.95%	55.54%	31.74%
% of Total Communities	55.33%	25.74%	59.17%	38.46%

THE STATE'S SOLAR LANDSCAPE

There has been considerable solar development in New Mexico. Although the state is only 37th largest in population, it has the 18th most solar capacity.[2] Most of the development has been at the utility scale. Ample land availability and an excellent solar resource (third best in the country) make that development attractive. Residential solar development has remained steady in recent years.

State Policies and Programs. The state has relatively strong net metering laws and allows for third-party ownership of residential PV systems. Investor-owned utility Public Service Company of New Mexico has a REC Purchase Program where it agrees to purchase the RECs for $0.0025/kWh for eight years.

In 2019 and 2020, the state legislature considered a bill to support community solar programs, but it has not passed it so far. The bill included strategies for encouraging LMI participation, including a goal of 25 percent participation by low-income residents, subscription discounts for low-income subscribers, allowing energy assistance funds to be used for community solar subscriptions, and requiring utilities to offer on-bill repayment.[3]

Governor Michelle Lujan Grisham has been very supportive of solar development and the New Mexico Energy, Minerals and Natural Resources Division (EMNRD) has been engaged in a process to develop and implement a strategy for LMI solar. A centerpiece of the strategy has been the design and promotion of "PV on a Pole™," a concept that involves a pole-mounted array of four solar panels (see case study in Chapter 4 of Volume 1). EMNRD sees this technology as an especially good match for the state's LMI population because it works well with manufactured homes that cannot accommodate rooftop installations.

Economics of a Typical PV System. This project's analysis of typical costs for a 4-kW system in New Mexico shows that larger financial incentives would be necessary to help LMI homeowners pay for PV's upfront costs than in most of the 14 target states. That might initially seem surprising, because of the strong solar resource and electricity rates that are roughly average among states that were examined. However, residential solar installation costs currently run higher in New Mexico than in most locations.

Part of EMNRD's focus on PV on a Pole™ has been to design a less expensive system. The division hopes to achieve installation costs of roughly $3/kW, which is below the current estimated cost of $3.92/kW. If that price point could be achieved and if it could be combined with

2 Solar Energy Industries Association, "New Mexico Solar" webpage, accessed March 22, 2021, *https://www.seia.org/state-solar-policy/new-mexico-solar.*

3 John Farrell, "Could New Mexico's Proposed Community Solar Program Raise the Bar?" Clean Technica, June 2019, *https://cleantechnica.com/2019/06/17/could-new-mexicos-proposed-community-solar-program-raise-the-bar.*

third-party ownership and/or other incentives, solar for LMI manufactured housing could provide meaningful financial benefits to the residents.

Solar Industry Perspectives. Solar installers have placed PV systems on some manufactured homes when the roofs would accommodate them. But one installer told us that he does not try to do that and instead focuses on ground-mounted systems because rooftop installations require an installer with a special license (MHD-2). Other solar installers noted other obstacles they have encountered when trying to serve the New Mexico manufactured housing market. They especially emphasized customers' difficulty securing financing. They mentioned issues with credit scores and the debt-to-income ratio that prevent LMI manufactured homeowners from qualifying for solar loans. One installer noted that even when customers did not have any negative credit issues, they still faced loan application denials from lenders.

Utility Programs and Perspectives. A few of New Mexico's 16 rural electric cooperatives and seven municipal utilities have been especially supportive of solar. Most notably, Kit Carson Electric Cooperative (KCEC), the second largest cooperative in the state serving over 20,000 members about northern New Mexico, is setting an example for rural electric cooperatives across the US in how to provide members with solar energy to lower electricity costs. In May 2020, KCEC announced the completion of its 17th solar array, its largest yet (3 MW), which was developed as part of a commitment since 2010 to provide solar energy in response to member demand. KCEC has rejected constructing one large solar array on a site that was distant from its members' neighborhoods and has instead built community solar arrays closer to where the members live, allowing them to take ownership and continue their involvement in bringing the community solar arrays to reality. An additional goal of KCEC has been to ensure that access to solar energy becomes more inclusive by encouraging participation of LMI and fixed-income members in the solar programs offered by the cooperative.[4]

RECOMMENDATIONS

New Mexico has the makings for a successful LMI manufactured homes initiative, but it will need to take steps to improve project economics. This could be done in several ways.

The two technologies that have some traction already and could be scaled up are community solar and PV on a Pole™. The existing experience with community solar and the possibility of legislation on the topic make that a realistic possibility. For PV on a Pole™ to be successful, the cost of installations needs to fall at least to the level of EMNRD's price target. For that to occur, a pipeline of projects needs to be developed for a producer to make the systems and achieve economies of scale, resulting in lower per-unit cost. New financing mechanisms and special LMI solar incentives, combined with efficient marketing, could make a system producer feel this is realistic.

Both technologies require partners and cost-effective marketing. EMNRD should continue its efforts to interest utilities other than KCEC in promoting solar in ways that provide benefits to LMI customers. Emphasis should be placed on those utilities that have clusters of manufactured

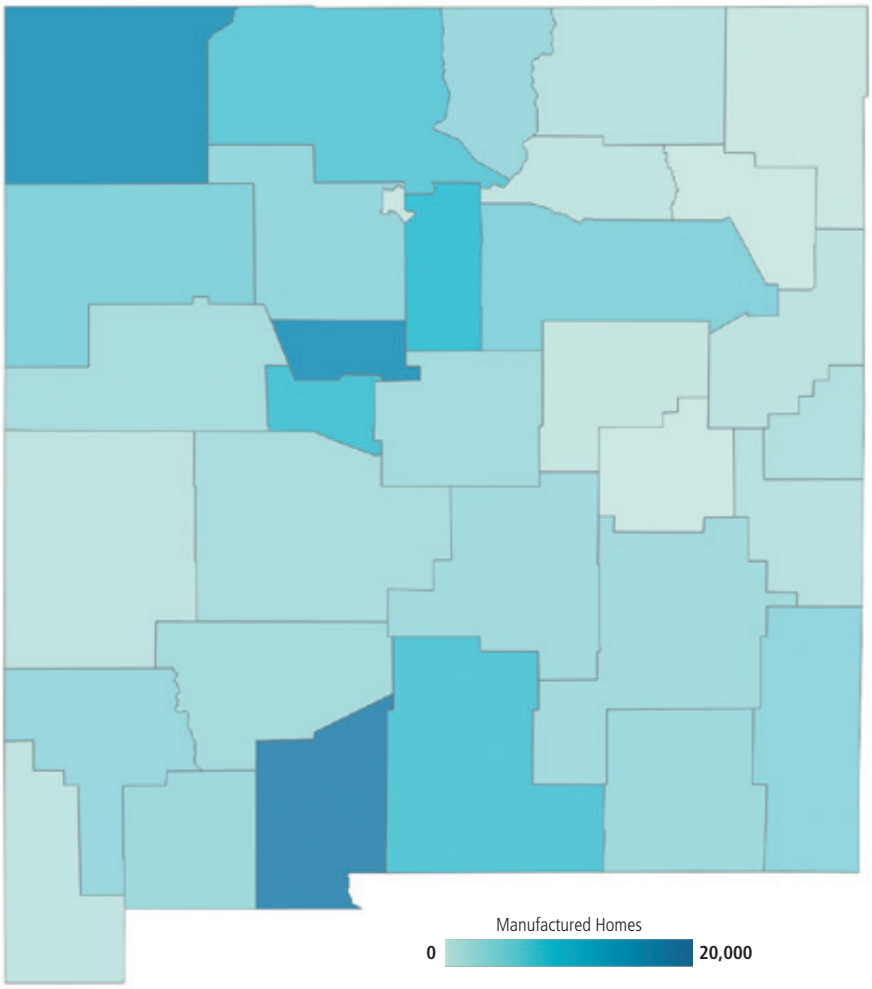
4 John Farrell, "Two Rural Electric Cooperatives Overcome Barriers to Clean Energy," Clean Technica, January 2019, *https://cleantechnica.com/2019/01/14/two-rural-electric-cooperatives-overcome-barriers-to-clean-local-energy.* See also Kit Carson Electric Cooperative, "100% Daytime Solar Energy by 2022" webpage, *https://kitcarson.com/electric/100-daytime-solar-energy-by-2022.*

homes, especially large communities. A marketing campaign could be efficient if it used the community's homeowners'association and other mechanisms for disseminating information within the community. A Solarize-style campaign could work well in such a setting—either seeking to offer PV on a Pole™ or a subscription to a shared community solar project. Some informal subdivisions could also be appropriate focuses for marketing.

Manufactured homes are a sufficiently important part of the new homes market in New Mexico that it would be desirable to undertake efforts to ensure that home purchasers have an option to buy a solar-ready manufactured home and to purchase a rooftop system that can be included as part of the financing on the home. EMNRD has discussed with some manufactured home dealers the possibility of offering PV on a Pole™ to customers at the time of home purchase. But it would also be desirable to make it possible for new home purchasers to have a rooftop system as an option.

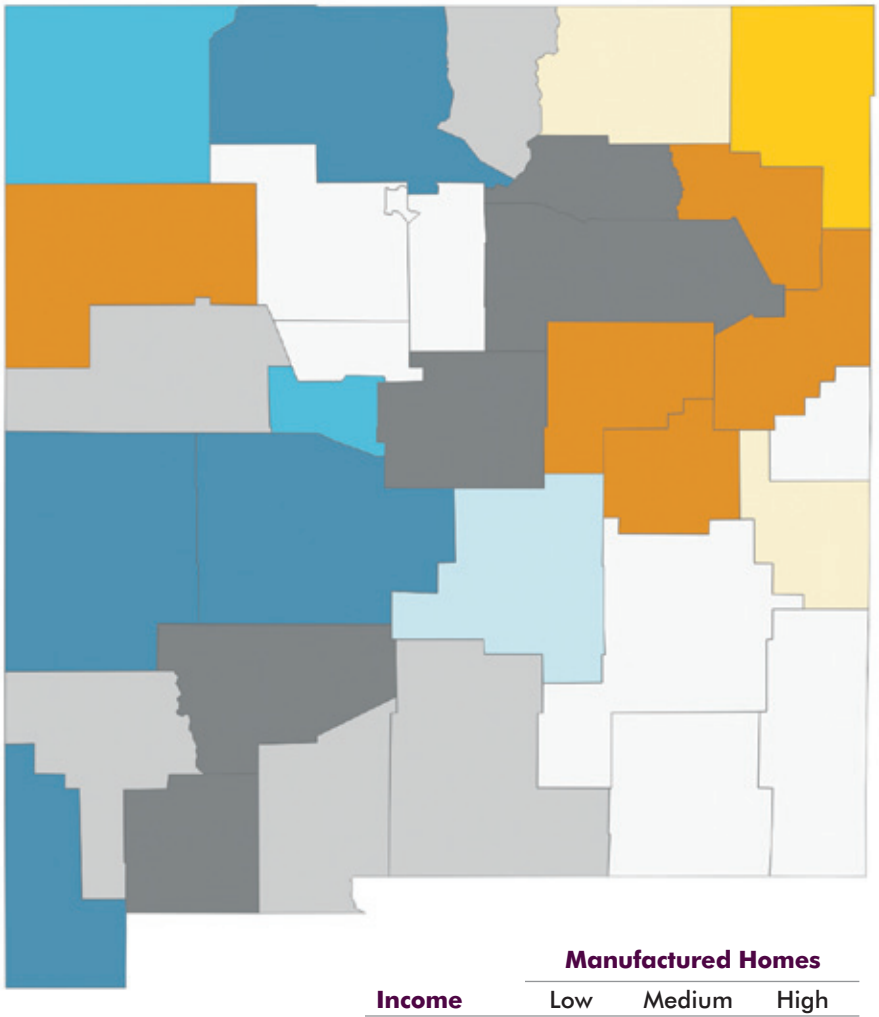
THE GEOGRAPHY OF NEW MEXICO'S MANUFACTURED HOMES

FIGURE NM1: **Total Manufactured Homes**



This map shows the total number of manufactured homes per county, as estimated in the US Census Bureau's 2019 American Community Survey.

FIGURE NM2: **Manufactured Homes vs. Household Income**



	Manufactured Homes		
Income	Low	Medium	High
Low			
Medium			
High			

This map includes two variables for each county: the percentage of the housing stock that is manufactured homes and the median household income. This shows the correlation between manufactured homes housing stock and areas with low incomes.

TABLE NM2: **Communities and Homesites by Utility**

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Alpena Power Co.	1	144	0
Central New Mexico Electric Coop., Inc.	3	207	2
Central Valley Elec Coop., Inc.	4	4	4
City of Aztec, New Mexico (Utility Co.)	7	438	4
City of Farmington, New Mexico (Utility Co.)	24	1,670	17
City of Gallup, New Mexico (Utility Co.)	11	1,402	1
City of Truth or Consequences, NM (Utility Co.)	6	124	0
Cleco Power, LLC	1	104	0
Columbus Electric Coop., Inc.	1	8	0
Continental Divide Electric Coop., Inc.	11	1,875	6
El Paso Electric Co.	42	3,513	18
Farmers Rural Electric Coop. Corp.	2	127	0
Jemez Mountains Electric Coop., Inc.	12	507	3
Kit Carson Electric Coop., Inc.	4	86	4
Lea County Electric Coop., Inc.	5	140	3
Los Alamos County	2	260	1
Mora-San Miguel Electric Coop., Inc.	4	81	1
Navajo Tribal Utility Authority	14	463	1
Otero County Electric Coop., Inc.	2	2	1
Public Service Co. of New Mexico	142	10,498	101
Raton Public Service Co.	3	3	0
Roosevelt County Electric Coop., Inc.	4	67	2
Socorro Electric Coop., Inc.	6	115	0
Southwestern Public Service Co.	41	1,039	18
Springer Electric Coop., Inc.	1	44	0
Town of Springer, NM (Utility Co.)	1	19	0

DATA ABOUT NEW MEXICO'S MANUFACTURED HOME COMMUNITIES

Community Size

TABLE NM3: **Number of Manufactured Home Communities by Size**

Category Range (sites in community)	Category Count	% of Total Communities with Site Counts
Large: >100	**68**	**29.69%**
>500	6	
300–499	11	
100–299	51	
Medium: 50–99	**67**	**29.26%**
75–99	25	
50–74	42	
Small: 1-49	**94**	**41.05%**
25–49	51	
1–24	43	
Communities without Site Counts	**133**	
Total Number of Communities	**362**	

TABLE NM: **Homesites by Community Size**

Community Size	Sites	% of Sites
Large	16,977	70.41%
Medium	4,610	19.12%
Small	2,523	10.46%
Total Sites	**24,110**	**100%**

Community Income

1. State Median Household Income — $49,754

TABLE NM5: **Communities in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
Community Count	187	87	200	130
Site Count	13,276	6,498	13,390	7,653
% of Sites	55.06%	26.95%	55.54%	31.74%
% of Total Communities	55.33%	25.74%	59.17%	38.46%

TABLE NM6: **Income by Community Size**

		Small	Medium	Large
LMI Communities (by CBSA)	Community Count	49	34	43
	Site Count	1,378	2,311	9,723
	% of Sites	52.13%	50.75%	63.24%
	% of Total Communities	21.40%	14.85%	18.78%
Low-Income Communities (by CBSA)	Community Count	24	20	26
	Site Count	719	1,344	6,607
	% of Sites	25.53%	29.85%	38.24%
	% of Total Communities	10.48%	8.73%	11.35%

2. Communities Restricted to Ages 55+

TABLE NM7: **Total Number of Communities with Age Restrictions**

Number of Age-Restricted Communities	Sites	Percent of All Communities	Percent of All Sites
26	2,633	7.18%	10.92%

TABLE NM8: **Age-Restricted Communities in LMI Census Tracts (by CBSA)**

	Small	Medium	Large
Total Number	**7**	**9**	**9**
LMI Communities	3	5	5
% of Age-Restricted Communities	11.54%	19.23%	19.23%
Low-income	**0**	**5**	**5**
% Age-Restricted Communities	0.00%	19.23%	19.23%

North Carolina

THE STATE'S MANUFACTURED HOUSING STOCK

North Carolina has more manufactured homes (594,578) than any other state except Florida and Texas, according to the US Census Bureau. Thirteen percent of the state's housing stock is manufactured housing. Most of these homes are located on privately owned individual plots of land rather than in manufactured home communities.

Even so, North Carolina has the third most communities (2,691) in the Datacomp database. The database has identified 62,009 homesites, which account for 10.4 percent as many homes as listed by the Census Bureau. But the database is missing site counts for 1,830 communities, which is 68 percent of all the communities and is a higher percentage than for most other states. Datacomp believes that the communities without site information are much more likely to be small than large, and that some communities with site counts could have closed in recent years; but there is a good chance that the total number of homesites in communities is somewhat more than the 10.4 percent that have been identified. Even if the missing homesites were to be added in, it would remain true that the vast majority of manufactured homes in North Carolina are located outside of manufactured home communities.

Among the manufactured home communities with site counts, most are small. Because the large communities, by definition, have more homesites, most homesites (59.30 percent) in the database are in located in 185 large communities with over 100 homesites. Two communities have more than 500 homesites. Relatively few communities (37) are age restricted.

More than half the communities and homesites in the Datacomp database are in an LMI census tract, when measured against the state median household income. The numbers are lower when measured against the household income of the core-based statistical area (CBSA). This emphasizes that a disproportionate share of the communities are located in parts of the state with below-average incomes (see maps at the end of this section). The large communities and those without site counts are more likely to be in LMI census tracts.

North Carolina has a robust new homes market. Although manufactured housing represents only a small share of the total, the large size of the market means that many manufactured homes are being sold there (third most among all states). In 2019, 4,871 manufactured homes were shipped to market, compared to 51,642 building permits issued in that same year for site-built, single-family homes.[1]

1 US Census Bureau, "U.S. Manufactured Housing Shipments by State: 2019," *https://www2.census.gov/programs-surveys/mhs/visualizations/2019/2019usmapbystate.pdf*; US Census Bureau, "Building Permits Survey Annual Data," *https://www.census.gov/construction/bps/stateannual.html*.

TABLE NC1: **North Carolina Communities and Sites in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
% of Sites	45.55%	20.72%	56.15%	31.81%
% of Total Communities	53.77%	20.08%	68.34%	36.86%

Manufactured home communities and homesites are spread among many utility service territories across the state. The largest number of manufactured homes are in the Duke Energy service territory (1266 communities and 31,521 homesites).

THE STATE'S SOLAR LANDSCAPE

North Carolina is second only to California in the total amount of solar installed. Several factors contributed to this, including a state 35 percent tax credit (that expired in 2015), a high size limit of PURPA standard offer projects, relatively high avoided cost rates (since reduced), and the state's Renewable Energy and Efficiency Standard (REPS), which was established in 2007 and requires that 12.5 percent of the state's energy production must come from renewable sources by 2021. The pace of solar development has slackened a little, but North Carolina still ranked 5th among all states in capacity added in 2020. More than 90 percent of the state's solar has been utility scale, but the residential market has been increased gradually since 2017.[2]

The relatively low cost of electricity (13th lowest in the nation) makes it more difficult for residential solar to provide cost savings than in many states. On the other hand, North Carolina offers a favorable net metering policy, with compensation at the retail rate. A downside is that unused credits transfer annually to the utility, without compensation, at the beginning of the summer. Solar leases with third-party ownership of residential PV systems are permitted, but power purchase agreements are not.

Economics of a Typical PV System. The analysis of typical costs for a 4-kW system suggests that the economics of PV are more favorable than in some states, but significant new financial incentives would still be necessary to help LMI homeowners pay for the upfront costs. Installation costs are lower than in many states.

One North Carolina solar installer identified the high upfront costs for solar installations as the primary impediment to expanding LMI solar manufactured homes. He also mentioned a need for more education to increase awareness of the potential for solar energy to reduce LMI residents' electricity costs.

Utility Programs and Perspectives. A utility solar rebate program is authorized by the North Carolina Utilities Commission. Residential rebates tend to be fully subscribed quickly after they are opened to subscribers.

2 Solar Energy Industries Association, "North Carolina Solar" webpage, accessed March 23, 2020, *https://www.seia.org/state-solar-policy/north-carolina-solar.*

Duke Energy has committed to significantly expanding its use of clean energy and has been developing utility-scale renewable energy projects. In September 2020, along with partners in the solar industry and nonprofit sector, the utility proposed a modification to net metering, called Solar Choice Net Metering, and has submitted the concept for regulatory approval in South Carolina. This change would seek to expand the amount of rooftop solar while incorporating time-of-day pricing and demand reduction to make the solar more beneficial for the electricity system and all ratepayers.[3] If approved by regulators in South Carolina, Duke Energy will likely propose something similar in North Carolina.

Legislation in the form of HB 589 required Duke Energy to develop a community solar program, but it requires the credit rates to be pegged at avoided cost. The program has been approved but not rolled out yet.

Some of the state's 26 rural electric cooperatives and 72 municipal utilities have also been developing solar. In July 2020, The North Carolina Electric Cooperatives, a network of 26 rural electric coops that provide electricity for approximately 2.5 million residents in 93 counties, announced a goal of a 50 percent reduction in carbon emissions from 2005 levels by 2030, and net zero carbon emissions by 2050. As of 2018, 11 coops in North Carolina had developed utility-owned community solar arrays that allow their members to pay a per-panel subscription fee. In return, the members receive a monthly credit on their electric bills for the amount of energy these panels produce. The state's net metering rules only apply to investor-owned utilities, so municipal utilities and coops do not have to offer retail rate net metering. Coops with community solar programs typically provide credits to the customer based on the utility's avoided cost of energy.[4]

As an example, the Cape Hatteras Electric Cooperative (CHEC), located in the Outer Banks, operates a 50-kilowatt (kW) community solar array that has 180 panels. The cooperative's members can purchase rights to one or more solar panels—up to a total of ten panels—for a one-time fee, and the cooperative offers an on-bill financing option. The lifetime of the project is estimated to be 20 years. If a member decides to no longer participate, the cooperative will purchase the energy rights back from the member at their amortized value. As an island with scarce available property, one of the biggest challenges for CHEC in establishing the solar array was to find an affordable half-lot acre, which was ultimately offered to the cooperative along the island's only highway.[5]

The Fayetteville Public Works Commission developed the state's first municipal community solar array. It includes solar plus battery storage and saves customers money starting in the first year.[6]

Several other utilities offer on-bill financing for energy efficiency and/or heat pumps.

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3 Duke Energy, "Duke Energy Reaches Deal with Vote Solar, Sunrun, Renewable Energy Advocates to Modernize, Expand Rooftop Solar in South Carolina," press release, September 16, 2020, *https://news.duke-energy.com/releases/duke-energy-reaches-deal-with-vote-solar-sunrun-renewable-energy-advocates-to-modernize-expand-rooftop-solar-in-south-carolina*.

4 Allison Eckley, "The Current State of Community Solar in North Carolina," NC Sustainability Energy Association, January 2018, https://energync.org/the-current-state-of-community-solar-in-north-carolina.

5 Cape Hatteras Electric Cooperative, "Community Solar" webpage, *https://www.chec.coop/communitysolar.*

6 Fayetteville Public Works Commission Community Solar web page, *https://www.faypwc.com/community-solar.*

RECOMMENDATIONS

Any solar initiative for manufactured housing in North Carolina would need new funding to make solar financially beneficial for the LMI residents, but some aspects of the solar landscape provide building blocks for success.

As a near-term priority, there should be discussions with the North Carolina Utilities Commission, as well as with Duke Energy and its partners, to make sure that LMI households—and manufactured home residents in particular—are considered when plans for the community solar program established under HB589 are evaluated for approval. Ideally, there should be extra compensation for LMI households and/or reduced risks for them when subscribing to a community solar project.

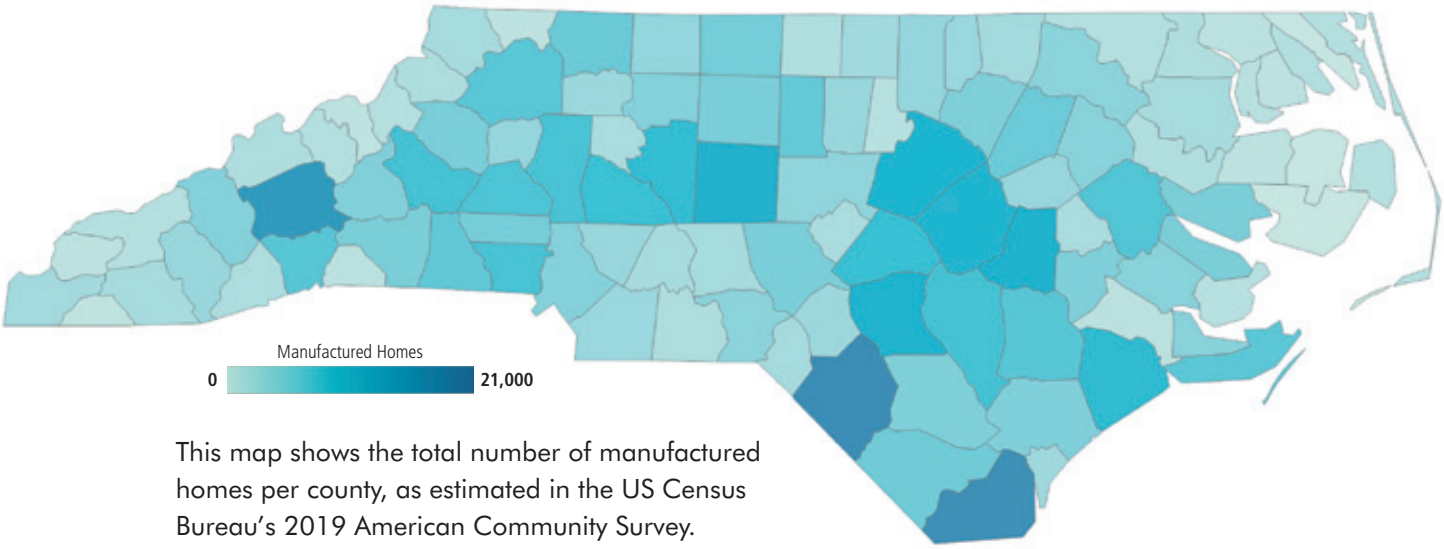
There are many manufactured homes in Duke Energy's service territory and special outreach campaigns could target some of them. Solarize-style marketing campaigns could work well for some of the larger manufactured home communities or in other locations with high concentrations of manufactured homes.

Some of the rural coops and municipal utilities could also offer programs targeted, at least in part, at manufactured homes, but emphasis should be placed on those utilities that have clusters of manufactured homes. Because many of the cooperatives have experience with community solar, they could be encouraged to develop new projects that enable manufactured home residents to subscribe risk-free and save money. Some of the cooperatives could also extend on-bill financing to onsite solar installations for manufactured homes, especially those that are not in manufactured home communities.

The market for new manufactured homes is sufficiently large in North Carolina that it would be desirable to undertake efforts to ensure that house purchasers have an option to buy a solar-ready manufactured home and to purchase a rooftop system that can be included as part of the financing for the home.

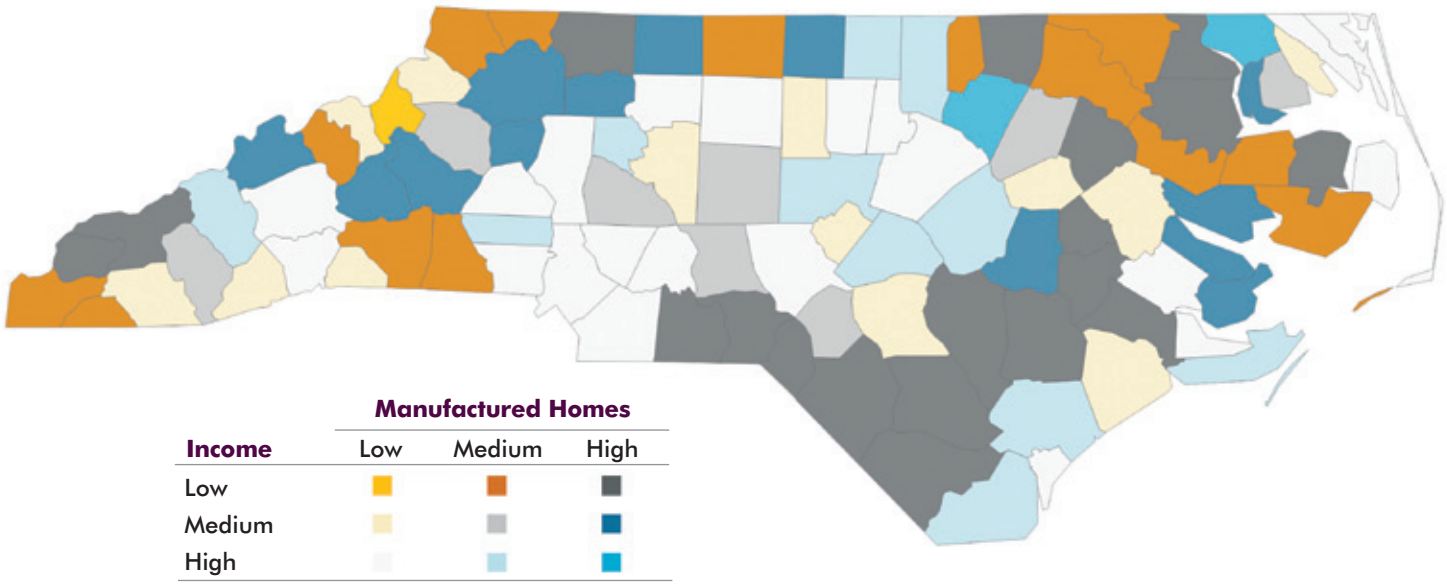
THE GEOGRAPHY OF NORTH CAROLINA'S MANUFACTURED HOMES

FIGURE NC1: **Total Manufactured Homes**



This map shows the total number of manufactured homes per county, as estimated in the US Census Bureau's 2019 American Community Survey.

FIGURE NC2: **Manufactured Homes vs. Household Income**



This map includes two variables for each county: the percentage of the housing stock that is manufactured homes and the median household income. This shows the correlation between manufactured homes housing stock and areas with low incomes.

TABLE NC2: **Communities and Homesites by Utility**

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Albemarle Electric Member Corp.	11	485	4
Blue Ridge Elec Member Corp.	5	106	2
Brunswick Electric Member Corp.	11	90	3
Carteret-Craven El Member Corp.	34	2,175	11
Central Electric Membership Corp.	81	453	13
City of Elizabeth City, NC (Utility Co.)	2	13	1
City of Kinston, NC (Utility Co.)	2	2	0
City of Laurinburg, NC (Utility Co.)	2	2	0
City of Lexington, NC (Utility Co.)	1	0	0
City of Lumberton, NC (Utility Co.)	6	71	3
City of New Bern, NC (Utility Co.)	2	6	1
City of Newton, NC (Utility Co.)	2	0	0
City of Public Works Commission–Fayetteville, NC (Utility Co.)	22	851	16
City of Rocky Mount, NC (Utility Co.)	5	288	3
City of Washington, NC (Utility Co.)	1	1	0
City of Wilson, NC (Utility Co.)	8	94	3
City of Winterville, NC (Utility Co.)	1	270	0
Dixie Electric Membership Corp.	1	1	0
Duke Energy Carolinas, LLC	1,266	31,521	561
Edgecombe-Martin County Electric Membership Corp.	13	863	4
EnergyUnited Electric Membership Corp.	47	860	23
Flint Electric Membership Corp.	1	1	0
Four County Electric Membership Corp.	24	1,139	10
French Broad Electric Membership Corp.	12	58	4
Golden Valley Electric Association, Inc.	1	24	0
Greenville Utilities Commission	1	1	1
Halifax Electric Membership Corp.	5	5	0
Haywood Electric Membership Corp.	90	729	34
Jones-Onslow Electric Membership Corp.	70	1,540	11
Lumbee River Electric Membership Corp.	54	1,730	23
Meriwether Lewis Electric Coop.	1	20	0
Modesto Irrigation District	1	1	0
Mountain Electric Coop., Inc.	5	23	0
New River Light & Power Co.	3	170	2
Pacific Gas & Electric Co.	3	49	0

TABLE NC2: **Communities and Homesites by Utility** (CONTINUED)

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Pee Dee Electric Membership Corp.	6	6	1
Piedmont Electric Membership Corp.	21	582	5
Pitt & Greene Electric Membership Corp.	18	181	10
PPL Electric Utilities Corp.	2	2	0
Roanoke Electric Membership Corp.	7	139	0
Rutherford Electric Membership Corp.	71	1,414	39
South Carolina Electric & Gas Co.	1	1	0
South River Electric Membership Corp.	78	516	23
Surry-Yadkin Electric Membership Corp.	8	307	4
Tennessee Valley Authority (Mississippi)	185	3,891	80
Thurmont Municipal Light Co.	1	1	0
Tideland Electric Membership Corp.	6	56	5
Town of Benson, NC (Utility Co.)	1	1	0
Town of Black Creek, NC (Utility Co.)	3	69	0
Town of Farmville, NC (Utility Co.)	1	1	0
Town of La Grange, NC (Utility Co.)	1	1	0
Town of Louisburg, NC (Utility Co.)	3	3	1
Town of Lucama, NC (Utility Co.)	3	3	0
Town of Maiden, NC (Utility Co.)	1	0	1
Town of Pikeville, NC (Utility Co.)	2	28	1
Town of Pinetops, NC (Utility Co.)	3	10	0
Town of Red Springs, NC (Utility Co.)	1	1	0
Town of Selma, NC (Utility Co.)	3	3	0
Town of Sharpsburg, NC (Utility Co.)	4	337	1
Town of Smithfield, NC (Utility Co.)	1	1	0
Town of Tarboro, NC (Utility Co.)	2	2	1
Town of Wake Forest, NC (Utility Co.)	2	0	0
Town of Waynesville, NC (Utility Co.)	2	0	2
Town of Windsor, NC (Utility Co.)	1	25	0
Tri-County Electric Membership Corp.	23	573	5
Tri-State Electric Membership Corp.	1	1	0
Union Electric Membership Corp.	11	572	5
Virginia Electric & Power Co.	91	1,401	30
Wake Electric Membership Corp.	59	871	30
Westar Energy, Inc.	1	1	0
White River Valley Electric Coop., Inc.	1	1	0

DATA ABOUT NORTH CAROLINA'S MANUFACTURED HOME COMMUNITIES

Community Size

TABLE NC3: **Number of Manufactured Home Communities by Size**

Category Range (sites in community)	Category Count	% of Total Communities with Site Counts
Large: >100	**185**	**21.49%**
>500	2	
300–499	22	
100–299	161	
Medium: 50–99	**203**	**23.58%**
75–99	73	
50–74	130	
Small: 1-49	**473**	**54.94%**
25–49	219	
1–24	254	
Communities without Site Counts	**1,830**	
Total Number of Communities	**2,691**	

TABLE NC4: **Homesites by Community Size**

Community Size	Sites	% of Sites
Large	36,769	59.30%
Medium	13,996	22.57%
Small	11,244	18.13%
Total Sites	**62,009**	**100%**

Community Income

1. State Median Household Income — $54,602

TABLE NC5: **Communities in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
Community Count	1,170	437	1,487	802
Site Count	28,243	12,848	34,816	19,726
% of Sites	45.55%	20.72%	56.15%	31.81%
% of Total Communities	53.77%	20.08%	68.34%	36.86%

TABLE NC6: **Income by Community Size**

		Small	Medium	Large
LMI Communities (by CBSA)	Community Count	173	86	90
	Site Count	4,238	6,020	17,895
	% of Sites	36.58%	42.36%	48.65%
	% of Total Communities	20.09%	9.99%	10.45%
Low-Income Communities (by CBSA)	Community Count	62	43	44
	Site Count	1,552	2,974	8,322
	% of Sites	13.11%	21.18%	23.78%
	% of Total Communities	7.20%	4.99%	5.11%

2. Communities Restricted to Ages 55+

TABLE NC7: **Total Number of Communities with Age Restrictions**

Number of Age-Restricted Communities	Sites	Percent of All Communities	Percent of All Sites
37	2,446	1.37%	3.94%

TABLE NC8: **Age-Restricted Communities in LMI Census Tracts (by CBSA)**

	Small	Medium	Large
Total Number	**14**	**8**	**10**
LMI Communities	6	2	4
% of Age-Restricted Communities	16.22%	5.41%	10.81%
Low-income	**2**	**1**	**2**
% Age-Restricted Communities	5.41%	2.70%	5.41%

Ohio

THE STATE'S MANUFACTURED HOUSING STOCK

Only a small share (3.7 percent) of Ohio's housing stock is manufactured housing, but the total number of manufactured homes (194,322) is significant because the state has a relatively large population. What is most notable is that a high percentage of the homes are in manufactured home communities, second only to Michigan among the 14 target states. There is also an unusually high number of large manufactured home communities.

The Datacomp database for Ohio includes 2,142 communities—fifth highest among states—and 133,750 identified homesites. Those homesites represent 68.4 percent of the sites in the US Census Bureau's count. Only 12.7 percent of the communities are missing homesite counts. Compared to most other states, a smaller share of the manufactured homes are on individually owned plots of land.

Most manufactured home communities in the database are small. But because the large communities, by definition, have more homesites, most homesites (62.6 percent) in the database are in 370 large communities with over 100 homesites. Eight communities have more than 500 homesites. An above-average share of communities (7.1 percent) is restricted to residents older than 55. There are 153 such communities comprising 10.1 percent of homesites.

Most communities are in LMI census tracts when compared to the state median income ($56,602), but fewer are when compared to the median household income of the local core-based statistical area (CBSA). This emphasizes that a disproportionate share of the communities are in parts of the state with below-average area incomes (see maps at the end of this section). Large communities are more likely to be in LMI census tracts than smaller ones.

For a state its size, there has not been much new home construction in recent years, and the number of new manufactured homes has been small. In 2019, 1,828 manufactured homes were shipped to market, compared to 16,078 building permits issued in that same year for site-built, single-family homes.[1]

The largest number of manufactured home communities and sites are in the service territory of two large investor-owned utilities—AEP Ohio (519 communities with 22,311 site) and Ohio Edison (451 communities with 35,419). Another utility, Toledo Edison, which has the same parent company (FirstEnergy) as Ohio Edison, has 165 communities with 13,344 homesites

1 US Census Bureau, "U.S. Manufactured Housing Shipments by State: 2019," *https://www2.census.gov/programs-surveys/mhs/visualizations/2019/2019usmapbystate.pdf*; US Census Bureau, "Building Permits Survey Annual Data," *https://www.census.gov/construction/bps/stateannual.html*.

TABLE OH1: **Ohio Communities and Sites in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
% of Sites	44.15%	24.31%	57.20%	29.38%
% of Total Communities	47.72%	22.03%	65.23%	34.34%

in its service territory. There are also many communities located in the service territories of other investor-owned utilities and in some of Ohio's 25 rural electric cooperatives and 85 municipal utilities.

THE STATE'S SOLAR LANDSCAPE

Ohio ranks 23rd among states in solar capacity. Most of that is utility-scale and commercial solar, with especially large additions to utility-scale solar capacity in 2020. There has been a steady increase in the number of residential installations starting in 2018.[2]

State Policies. Ohio's energy policy has been unsettled since allegations of criminal activities by legislators in passing legislation in 2019 that supported the state's nuclear power plants and weakened the state's Renewable Portfolio Standard. It is expected that there will be changes to state energy policy in 2021, but it is unclear if any of them will have an impact on residential solar.

All utilities in Ohio must offer net metering to residential customers, but any excess solar energy generation will be credited to the customer's bill at only the per-kilowatt hour (kWh) generation charge. Ohio's cost of electricity ranks in the middle among states. Ohio allows third-party ownership of residential PV systems.

Economics of a Typical PV System. The cost analysis of a 4-kW system in Ohio suggests that the economics of PV are less favorable than in most target states, so larger new financial incentives would be necessary to help LMI homeowners pay for the upfront costs of a system. However, installation costs are also currently higher than in most states, so the situation could become more promising if the current growing residential solar market leads to economies of scale and competition brings down installation costs.

Solar Industry Perspectives. Five Ohio solar companies responded to the survey and indicated that the primary obstacle to LMI solar for manufactured homes is the lack of guaranteed financing for LMI customers. Several solar installers noted that manufactured homes were often structurally compromised and suggested that the best way to bring solar power to manufactured homes would be via adjacent ground-mounted systems or through community solar arrays. The installers also mentioned the need for information dissemination about the potential benefits of community solar projects for residents of LMI manufactured homes and owners of manufactured home communities.

2 Solar Energy Industries Association, "Ohio Solar" webpage, *https://www.seia.org/state-solar-policy/ohio-solar* (accessed March 23, 2020).

Utility Programs and Perspectives. Buckeye Power, Ohio's generation and transmission cooperative that provides power to Ohio-based rural electric cooperatives, has developed OurSolar community solar arrays at 23 locations throughout the state. Local rural electric cooperatives may offer subscriptions to these community solar arrays to their members as an alternative source of electricity generation. For example, Butler Rural Electric Cooperative, serving four counties in southwest Ohio, provides opportunities for members to purchase subscriptions to solar panels at a 228-panel community solar array that was completed in 2017, across the street from the cooperative's headquarters in Oxford. Members can subscribe to up to five solar panels on a first-come, first-served basis, with the energy generated by those panels to be calculated into members' monthly bills. The average cost for each member is approximately $2.00 per month, per panel, with the solar credit applied.

The description of the OurSolar program states that the solar cost will be in addition to the participating member's current electric bills and will not decrease a subscriber's monthly bill. It notes that although the current solar energy rate is higher than energy produced by traditional sources, the community solar rate will remain constant for the duration of the agreement, while the wholesale costs of other energy sources is likely to increase with market fluctuations. Members can choose a five-, ten- or twenty-year agreement, during which time the rate will be fixed but is subject to change once the agreement ends. If subscribers move, they can return their subscription to Butler Rural Electric Cooperative, at no cost. However, if the agreement is cancelled early for another reason, there is a $50 fee per panel.[3]

RECOMMENDATIONS

Any solar initiative for manufactured housing would need dedicated funding to make solar financially beneficial for the LMI residents. The most logical starting point for a new program would be a modest pilot initiative that could be offered in one or a few locations. The key to offering such an initiative would be finding willing partners able to provide some of the needed funding. This could be a state-funded program or could involve a utility. It might also be possible to recruit a philanthropic foundation or community-based organization that seeks to improve the lives of Ohio's low-income households.

With more than 83,000 households living in 370 communities with more than 100 homesites, some of those communities could be possible locations for a pilot. A solar marketing campaign could be efficient if it used the community's homeowners' association and other mechanisms for disseminating information within the community. A Solarize-style campaign could work well in such a setting—either seeking to offer a large number of identical rooftop, ground-mounted, or pole-mounted systems, or seeking subscribers to a shared community solar project.

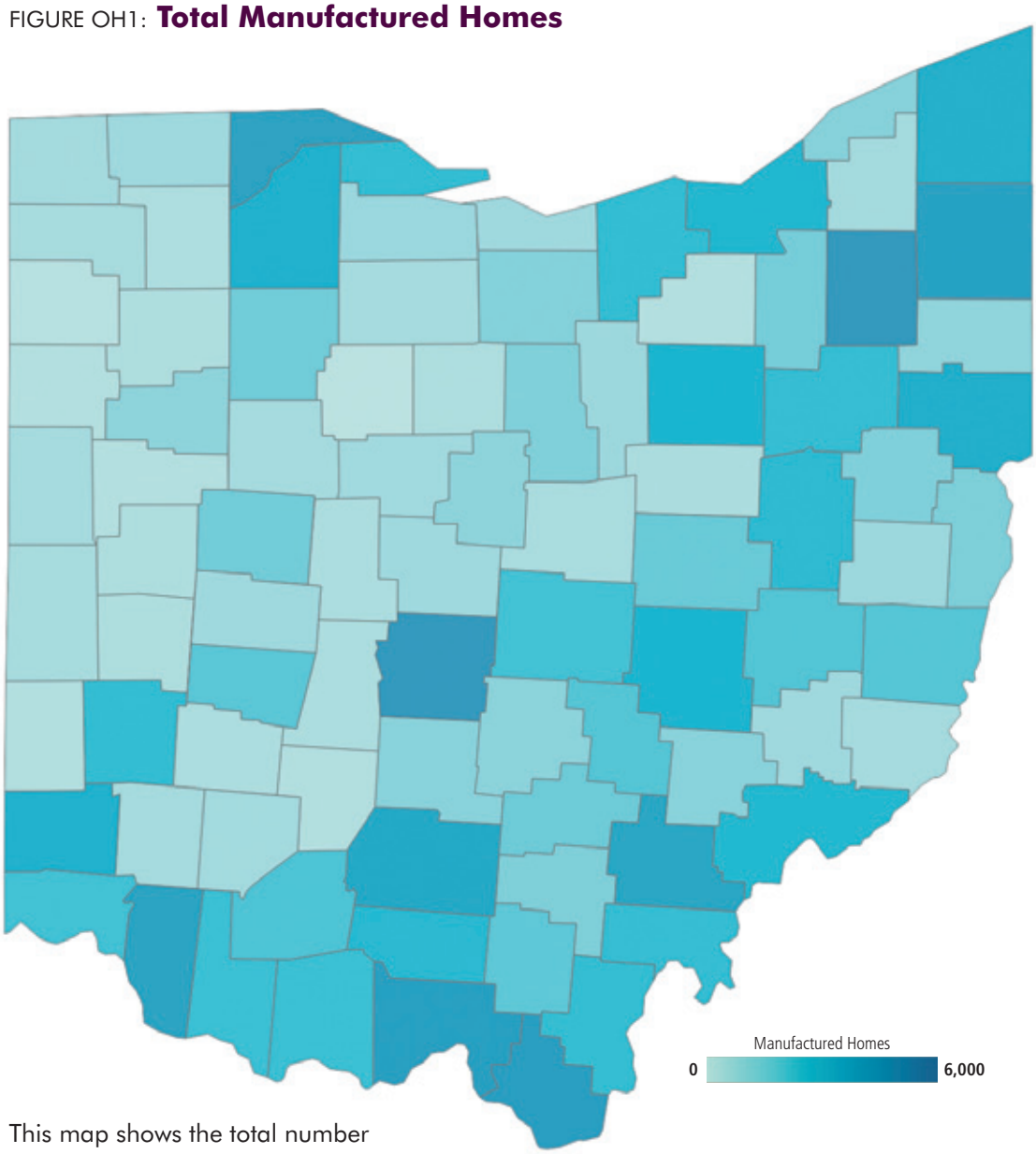
There are enough age-restricted communities in Ohio that they could perhaps be a focus for a pilot. But that would require special targeted education and outreach to overcome homeowners' possible hesitance to enter a long-term investment in solar. Senior residents would need to understand that a solar lease is connected to the house and not with them personally. They would need to be shown how they would benefit immediately from reduced electricity costs and how anyone who later purchased the house from them would also benefit.

3 Butler Rural Community Solar, *https://www.butlerrural.coop/content/butler-rural-community-solar.*

Perhaps AEP Edison or FirstEnergy, which have the most communities in their territories, could be encouraged to offer a pilot program for LMI manufactured-home owners as a means for alleviating poverty and reducing delinquent bill payments. Similarly, there could be outreach to some of the rural electric coops that have developed community solar projects, to see if they might offer a new community solar project that includes special provisions to provide financial relief to LMI residents. On the other hand, there may not be enough sales of new manufactured homes to justify making them a major focus.

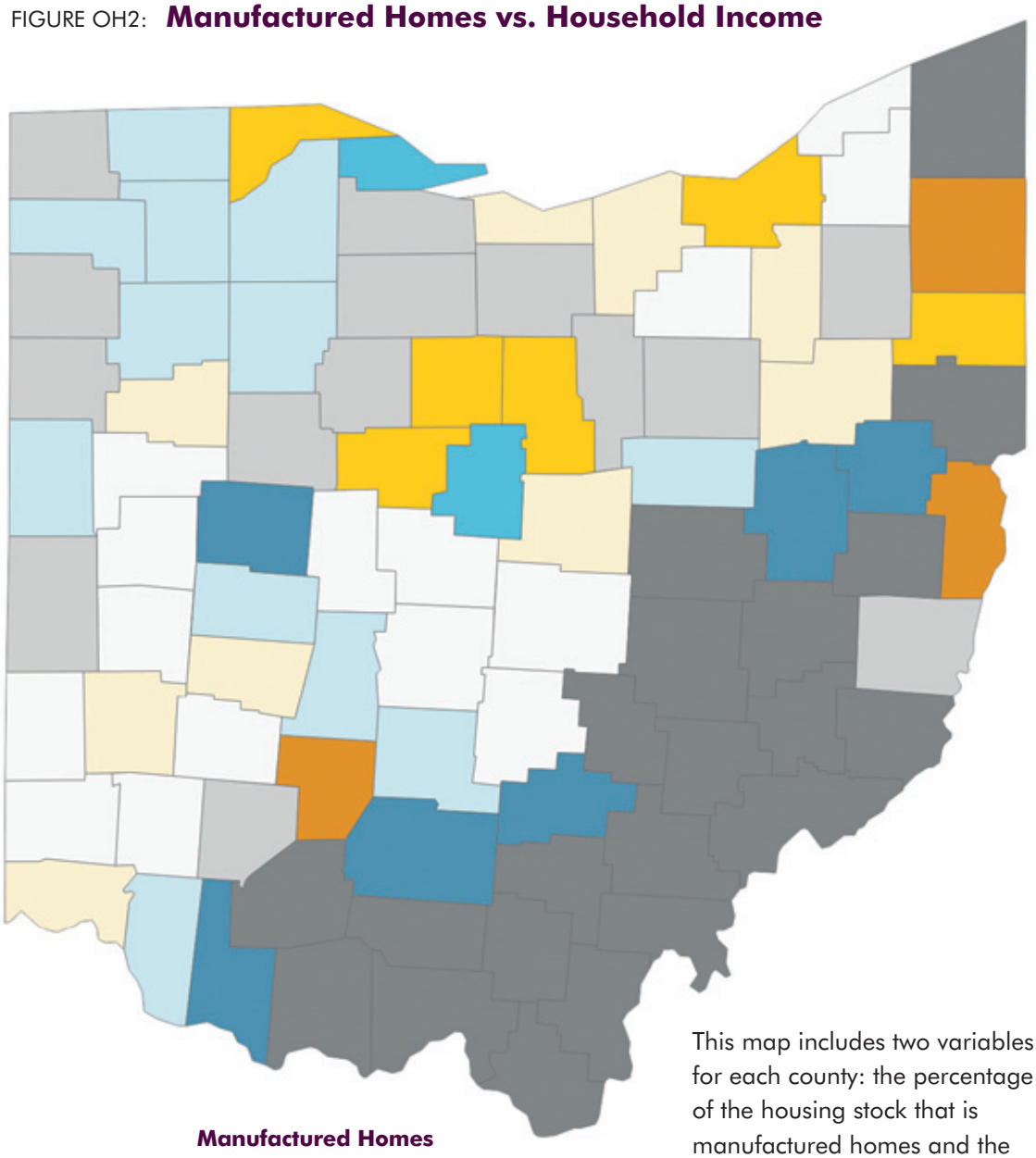
THE GEOGRAPHY OF OHIO'S MANUFACTURED HOMES

FIGURE OH1: **Total Manufactured Homes**



This map shows the total number of manufactured homes per county, as estimated in the US Census Bureau's 2019 American Community Survey.

FIGURE OH2: **Manufactured Homes vs. Household Income**



	Manufactured Homes		
Income	Low	Medium	High
Low			
Medium			
High			

This map includes two variables for each county: the percentage of the housing stock that is manufactured homes and the median household income. This shows the correlation between manufactured homes housing stock and areas with low incomes.

TABLE OH2: **Communities and Homesites by Utility**

Utility	Total Communities	Total Sites	LMI Communities by CBSA
AEP Ohio	519	22,311	148
Appalachian Power Co.	4	93	0
Carroll Electric Coop., Corp,	8	202	2
City of Amherst, Ohio (Utility Co.)	1	157	1
City of Celina, Ohio (Utility Co.)	8	305	5
City of Cleveland, Ohio (Utility Co.)	5	742	2
City of Columbus, Ohio (Utility Co.)	31	2,265	23
City of St Clairsville, Ohio (Utility Co.)	3	93	0
Cleveland Electric Illum Co.	110	9,562	45
Columbus Southern Power Co.	225	10,299	70
Consolidated Electric Coop.	6	486	2
Dayton Power & Light Co.	192	12,841	57
Duke Energy Ohio, Inc.	147	15,203	79
Holmes-Wayne Electric Coop., Inc.	8	444	3
Kansas City Power & Light Co.	1	32	0
Lorain-Medina Rural Electric Coop., Inc.	3	372	1
Mid-Ohio Energy Coop., Inc.	4	383	0
Ohio Edison Co.	451	35,419	185
Paulding-Putman Electric Coop., Inc.	4	92	1
Pioneer Rural Electric Coop., Inc.	8	489	4
South Central Power Co.	43	2,558	22
Southeastern Indiana Rural Electric Coop.	1	6	0
Southwestern Electric Power Co.	1	7	0
Tennessee Valley Authority (Mississippi)	1	92	0
The Toledo Edison Co.	165	13,344	57
Virginia Electric & Power Co.	11	394	0
Wise Electric Coop., Inc.	1	5	0

DATA ABOUT OHIO'S MANUFACTURED HOME COMMUNITIES

Community Size

TABLE OH3: **Number of Manufactured Home Communities by Size**

Category Range (sites in community)	Category Count	% of Total Communities with Site Counts
Large: >100	**427**	**22.83%**
>500	8	
300–499	49	
100–299	370	
Medium: 50–99	**400**	**21.39%**
75–99	136	
50–74	264	
Small: 1-49	**1,043**	**55.78%**
25–49	419	
1–24	624	
Communities without Site Counts	**272**	
Total Number of Communities	**2,142**	

TABLE OH4: **Homesites by Community Size**

Community Size	Sites	% of Sites
Large	83,669	62.56%
Medium	27,491	20.55%
Small	22,590	16.89%
Total Sites	**133,750**	**100%**

Community Income

1. State Median Household Income — $56,602

TABLE OH5: **Communities in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
Community Count	899	415	1,229	647
Site Count	59,050	32,513	76,505	39,300
% of Sites	44.15%	24.31%	57.20%	29.38%
% of Total Communities	47.72%	22.03%	65.23%	34.34%

TABLE OH6: **Income by Community Size**

		Small	Medium	Large
LMI Communities (by CBSA)	Community Count	435	180	189
	Site Count	9,743	12,552	36,755
	% of Sites	41.71%	45.00%	44.26%
	% of Total Communities	23.26%	9.63%	10.11%
Low-Income Communities (by CBSA)	Community Count	184	91	102
	Site Count	4,348	6,402	21,763
	% of Sites	17.64%	22.75%	23.89%
	% of Total Communities	9.84%	4.87%	5.45%

2. Communities Restricted to Ages 55+

TABLE OH7: **Total Number of Communities with Age Restrictions**

Number of Age-Restricted Communities	Sites	Percent of All Communities	Percent of All Sites
153	13,529	7.14%	10.12%

TABLE OH8: **Age-Restricted Communities in LMI Census Tracts (by CBSA)**

	Small	Medium	Large
Total Number	**52**	**48**	**45**
LMI Communities	25	26	24
% of Age-Restricted Communities	16.34%	16.99%	15.69%
Low-income	**17**	**16**	**14**
% Age-Restricted Communities	11.11%	10.46%	9.15%

South Carolina

THE STATE'S MANUFACTURED HOUSING STOCK

Manufactured homes represent a significant share (16.2 percent) of South Carolina's housing stock; only New Mexico has a greater percentage. According to the US Census Bureau, there are 371,360 manufactured homes in South Carolina. Most of these homes are located on privately owned individual plots of land rather than in manufactured home communities.

South Carolina has 859 manufactured home communities in the Datacomp database. The database has identified 47,344 homesites, which accounts for 12.8 percent of the homes identified in the Census Bureau's count. But the database is less complete than for most other states. Among other things, it is missing site counts for more than half of the communities (477 of the 859 communities listed). Datacomp believes that the communities without site information are much more likely to be small than large, so the total number of homesites in communities is likely to be more than the 12.8 percent that have been identified.

Even if the missing homesites are added in, it is still almost certain that most manufactured homes in South Carolina are located outside of manufactured home communities. Michael Lee of the Manufactured Housing Institute of South Carolina reports that a frequent pattern is to have a family plot of land with two or three manufactured homes for different members of the family. Informal subdivisions with several manufactured homes are also common.

Among manufactured home communities, about half with site counts in the database are small, having fewer than 49 residents. Because the large communities, by definition, have more homesites, most homesites (61.22 percent) in the database are in 110 large communities with over 100 homesites. Nine communities have more than 500 homesites. But assuming, as Datacomp believes, that most missing communities are likely to be small, it could be that half or more of the homesites are in communities with fewer than 100 sites. Very few communities (27) are age restricted.

Most of the communities in the Datacomp database are in a census tract that is low-income or moderate-income compared to the median household income of the core-based statistical area (CBSA) and the state median household income of $53,199. The share of identified homesites that are low income, as opposed to moderate income, is much smaller than the share of communities.

For a state of its size, South Carolina has a large, active new housing market. Although manufactured housing represents only a small share of the total, the overall size of the single-family home market means that many manufactured homes are being sold there. In 2019,

TABLE SC1: **South Carolina Communities and Sites in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
% of Sites	68.41%	17.87%	70.02%	28.54%
% of Total Communities	62.48%	31.82%	68.76%	43.36%

4,079 manufactured homes were shipped to market, compared to 31,052 building permits issued in that same year for site-built, single-family homes.[1]

The investor-owned utilities with the largest numbers of manufactured home communities in their service territories are Dominion Energy South Carolina and Duke Energy Carolinas. Among electric cooperatives, Berkeley Electric Coop, Horry Electric Cooperative, and York Electric Cooperative all have at least 25 communities and 1,000 identified homesites.

THE STATE'S SOLAR LANDSCAPE

South Carolina shows considerable promise for solar development. It ranks 13th among states in installed solar capacity with nearly 1,800 megawatts installed.

South Carolina's cost of electricity is in the middle range of electricity costs in the US, but a few utilities operating in the state have considerably higher rates.[2] South Carolina has 20 electric cooperatives[3] and 21 municipal utilities,[4] in addition to its four investor-owned utilities[5] and one state-owned electric utility, Santee Cooper.

State Policies and Utility Programs. In 2014, South Carolina enacted Act 236 (R241, S1189), which addressed major areas of solar development and helped lay the groundwork for significant solar growth in the state. Act 236 explicitly authorized solar leasing, established guidelines for net metering, and set capacity caps for both programs. It also provided a framework for regulated utilities to recover costs for utility-scale solar procurements.[6]

South Carolina offers a state solar tax credit. South Carolina taxpayers can claim 25 percent of eligible solar system costs up to $3,500 or 50 percent of the taxpayer's liability, whichever

1 US Census Bureau, "U.S. Manufactured Housing Shipments by State: 2019," *https://www2.census.gov/programs-surveys/mhs/visualizations/2019/2019usmapbystate.pdf*; US Census Bureau, "Building Permits Survey Annual Data," *https://www.census.gov/construction/bps/stateannual.html*.

2 Gonzalez, Laura Daniela, Master of Public Policy Candidate at the University of Virginia, "Increasing Solar Energy Choice for Low- and Moderate-Income Households in South Carolina," May 2020 (shared via email).

3 Electric Cooperatives of South Carolina, "Facts" webpage, accessed September 25, 2020, *https://ecsc.org/content/facts*.

4 Municipal Association of South Carolina, "SC Association of Municipal Power Systems" webpage, accessed September 25, 2020, *https://www.masc.sc/about/affiliate-associations/sc-association-of-municipal-power-systems*.

5 Dominion Energy South Carolina, Duke Energy Carolinas, Duke Energy Progress, and Lockhart Power Company. South Carolina Energy Office, "SC Energy Data," accessed, September 25, 2020, *http://energy.sc.gov/node/3072*.

6 South Carolina Energy Office, "Act 236," accessed April 9, 2021, *http://www.energy.sc.gov/files/view/Act%20236_Final_4-5-16.pdf*.

is lower. Any unused tax credit may be carried forward by the taxpayer for up to 10 years.[7] In addition, Santee Cooper customers who adopt solar may be eligible for incentives through the utility's Solar Home Program.[8]

In 2019, the South Carolina legislature enacted Act 62 (H3689, R82), which removed caps on solar leasing and net-metering. Act 62 secured retail-rate net metering for new customers until a successor program is established and implemented in June 2021. The Act encouraged all electric utilities in this state to consider offering community shared solar programs. It also authorized the South Carolina Public Service Commission to create "programs for the competitive procurement of energy and capacity from renewable energy facilities" and directed the Commission to "promote access to solar energy projects for low- and moderate-income customers."[9]

As part of a negotiated settlement requirement, South Carolina investor-owned utilities offer community shared solar programs with carve-outs for LMI customers.[10] The LMI components of these programs currently have waitlists.[11]

Under Act 62, South Carolina investor-owned Duke and Dominion were required to file proposals for successor tariffs to retail-rate net metering to take effect in 2021. In September 2020, Duke, with support from partners in the solar industry and nonprofit sector, proposed a modification to net metering, which it called Solar Choice Net Metering. The proposal seeks to incorporate time-of-day pricing and demand reduction to make rooftop solar generation more beneficial for the electricity system and South Carolina ratepayers. It provides residential solar customers the option of installing a smart thermostat along with their solar system and allows them to receive an incentive for the combination; however, it also includes an additional monthly fee based on system size and a minimum bill. If approved by regulators, the plan could increase the number of residential solar systems installed.[12]

South Carolina authorized on-bill financing for energy efficiency upgrades in 2010,[13] and more utilities, especially rural coops, offer on-bill financing than in almost any other states. In 2011 and early 2012, Central Electric Power Cooperative, the wholesale electricity provider for South Carolina's distribution electric cooperatives, and the Electric Cooperatives of South Carolina (ECSC), the trade association for electric cooperatives in the state, piloted the "Help My House" on-bill financing program. Supported by loan capital from the US Department of

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7 This state tax credit is supplemental to the federal investment tax credit for solar systems. DSIRE, "South Carolina Solar Energy, Small Hydropower, and Geothermal Tax Credit (Personal)," accessed September 25, 2020, *https://programs.dsireusa.org/system/program/detail/1803*.

8 Santee Cooper, "2020 Solar Home & Solar Share Home Program Manual," accessed September 25, 2020, *https://www.santeecoopersolar.com/_Assets/pdfs/Program-Manual-Solar-Home.pdf*.

9 Solar Industry, "Solar Soars in South Carolina with Energy Freedom Act," July 11, 2029, accessed September 25, 2020, *https://solarindustrymag.com/solar-soars-in-south-carolina-with-energy-freedom-act*.

10 The three principal investor-owned utilities in South Carolina have developed 20 megawatts of community shared solar and reserve 1.8 megawatts for LMI customers.

11 Email correspondence with Catherine Reed, Deputy Director of the South Carolina Energy Office, September 16, 2020.

12 Duke Energy, "Duke Energy Reaches Deal with Vote Solar, Sunrun, Renewable Energy Advocates to Modernize, Expand Rooftop Solar in South Carolina," press release, September 16, 2020, *https://news.duke-energy.com/releases/duke-energy-reaches-deal-with-vote-solar-sunrun-renewable-energy-advocates-to-modernize-expand-rooftop-solar-in-south-carolina*.

13 South Carolina Legislature, S.B. 1096, accessed September 25, 2020, *https://www.scstatehouse.gov/sess118_2009-2010/bills/1096.htm*.

Agriculture and designed with the specific goal of rehabilitating manufactured housing, the "Help My House" pilot program has successfully enabled customers in rural communities in South Carolina to make energy efficiency upgrades to their homes while reducing their energy bills.[14] There have been multiple stakeholder discussions about expanding on-bill financing in South Carolina beyond the "Help My House" program.

In 2009, South Carolina instituted an Energy Efficient Manufactured Homes Incentive Program, which eliminated the sales tax for purchases of Energy Star manufactured homes and provides a state income tax credit of $750 to qualified energy-efficient manufactured homebuyers.[15]

Economics of a Typical PV System. The cost analysis of a 4-kW system undertaken for this project suggests that the economics of PV are more favorable than in most of the 14 target states. However, the relatively favorable economics for a residential solar system in South Carolina could change after June 2021 when the Public Service Commission replaces net metering with a successor tariff. Public Service Commission docket proceedings are currently underway to establish a successor tariff.[16]

A 2019 Clean Energy Group report series titled *Resilient Southeast: Exploring Opportunities for Solar+Storage in Five Cities* ranked the City of Charleston, South Carolina second out of five Southeastern cities for economic opportunities to deploy solar PV and battery storage. The analysis for Charleston, which looked at four critical community building types, found that solar alone would be a positive investment for all building type scenarios, and that solar paired with battery storage would be economical for three out of the four building types modeled, including the multifamily housing property. Although this analysis did not examine solar for manufactured homes, it shows the potential for cost-effective solar development in the state and suggests an approach that could work for common facilitators at larger manufactured homes communities.[17]

Solar Industry Perspectives. Responses to our survey for South Carolina solar installers pointed to insufficient tax liability and credit scores as key obstacles for increasing solar penetration among LMI households. One installer described important structural issues that prevented installation of a rooftop solar system on a particular manufactured home. The installer noted that ground-mounted can increase installation costs.[18]

RECOMMENDATIONS

Any solar initiative for manufactured housing in South Carolina would need dedicated funding to make solar financially beneficial for the LMI residents, but some aspects of the solar landscape provide building blocks for success.

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14 Environmental and Energy Study Institute, "The Help My House Model" webpage, accessed September 25, 2020, *https://www.eesi.org/obf/case-study/helpmyhouse*.

15 South Carolina Energy Office, "Residential Manufactured Housing Energy Efficiency" webpage, accessed September 25, 2020.

16 South Carolina Public Service Commission, Dockets Dominion 220-229-E, Duke Carolinas 2019-170-E, and Duke Progress 2019-169-E, accessed April 9, 2021.

17 Clean Energy Group, "Resilient Southeast: Exploring Opportunities for Solar+Storage in Five Cities," April 25, 2019, accessed September 25, 2020, *https://www.cleanegroup.org/ceg-resources/resource/resilient-southeast*.

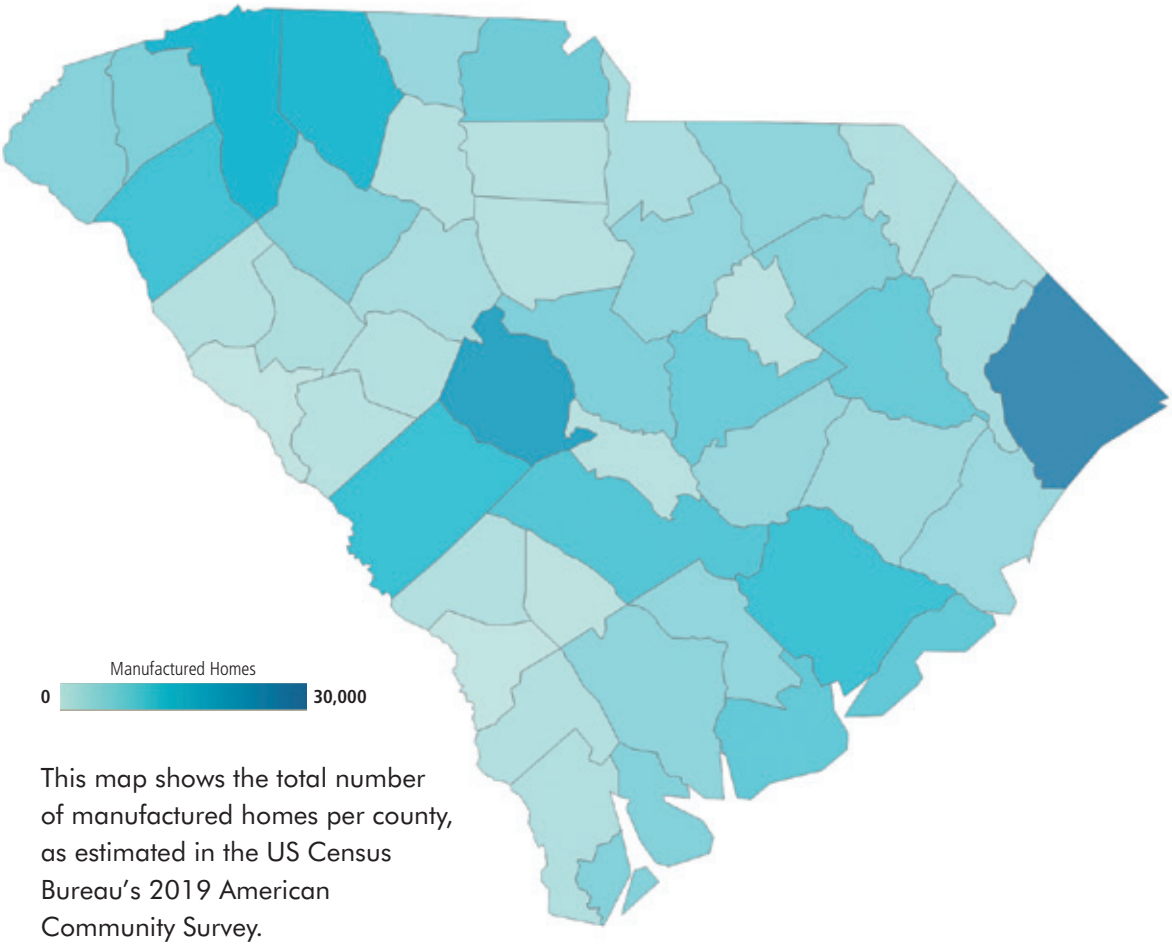
18 Response to CESA solar installer survey, April 2020.

With a large market for new manufactured homes and an existing mechanism for incentivizing the purchase of energy-efficient houses, perhaps the Energy Efficient Manufactured Homes Incentive Program could be modified to incorporate some additional support for including solar in new manufactured homes. This could help encourage manufactured home dealers to offer a solar-ready option and the possibility of including a rooftop PV installation in the financing.

Other actions that could support solar for manufactured homes include expanding the carve-outs for LMI participation in utility community solar programs and targeting outreach to manufactured home households. The existing utility on-bill financing programs could be modified to include solar, and special incentives and outreach could be targeted to manufactured housing homeowners.

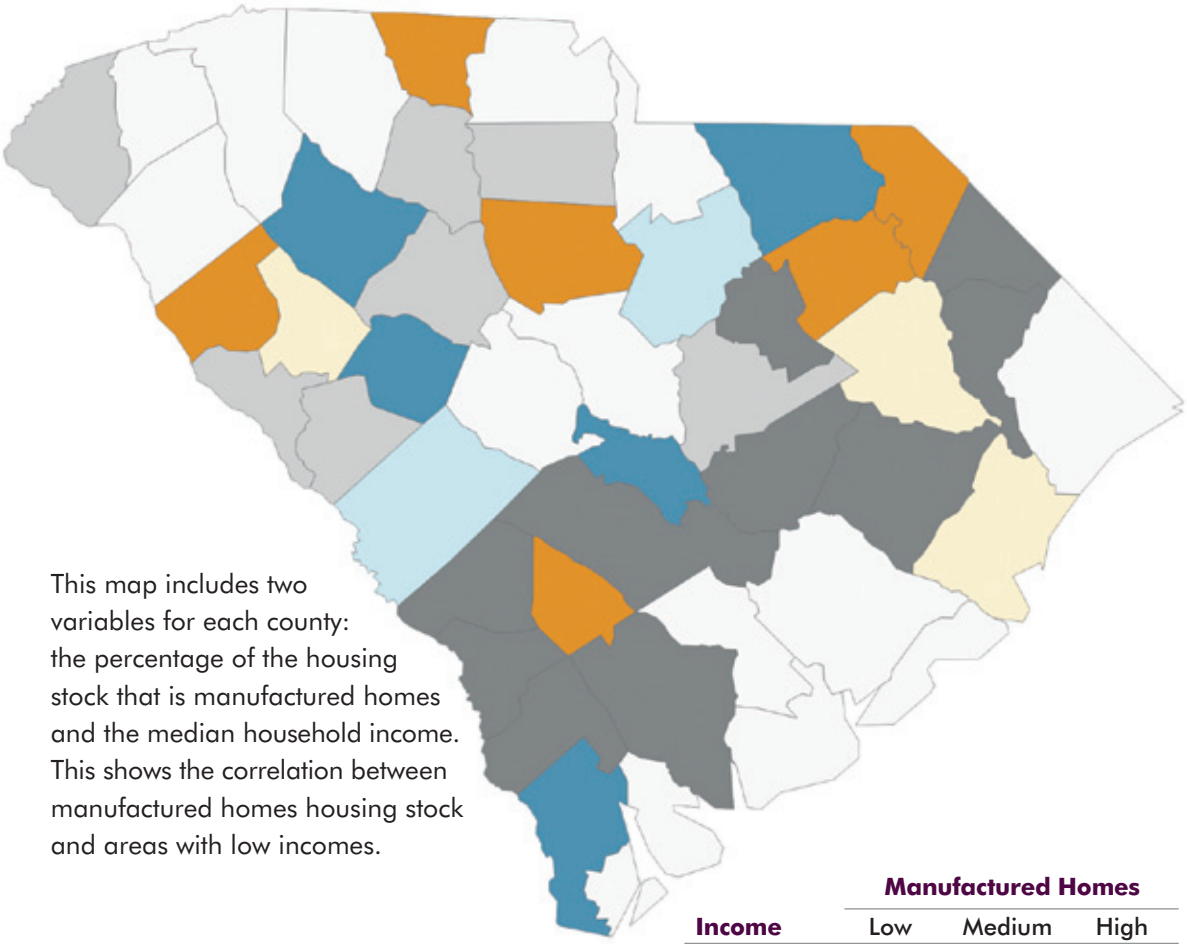
THE GEOGRAPHY OF SOUTH CAROLINA'S MANUFACTURED HOMES

FIGURE SC1: **Total Manufactured Homes**



This map shows the total number of manufactured homes per county, as estimated in the US Census Bureau's 2019 American Community Survey.

FIGURE SC2: **Manufactured Homes vs. Household Income**



This map includes two variables for each county: the percentage of the housing stock that is manufactured homes and the median household income. This shows the correlation between manufactured homes housing stock and areas with low incomes.

	Manufactured Homes		
Income	Low	Medium	High
Low			
Medium			
High			

TABLE SC2: **Communities and Homesites by Utility**

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Aiken Electric Coop., Inc,	36	391	15
Alabama Power Co.	1	1	0
Bamberg Board of Public Works	1	1	0
Berkeley Electric Coop., Inc.	36	2,596	24
Black River Electric Coop.	11	398	5
Broad River Electric Coop., Inc.	9	43	2
City of Bennettsville, SC (Utility Co.)	1	1	0
City of Gaffney, SC (Utility Co.)	2	14	1
City of Orangeburg, , SC (Utility Co.)	1	1	1
Coastal Electric Coop., Inc.	1	1	0
Consumers Energy Co.	1	1	0
Dominion Energy	243	11,434	154
Duke Energy Carolinas, LLC	258	17,064	106
Fairfield Electric Coop., Inc.	3	387	0
Georgia Power Co.	1	1	0
Greenwood Commissioners–Public Works	2	0	0
Greer Commission of Public Works	6	210	4
GreyStone Power Corp.	1	1	0
Horry Electric Coop., Inc.	72	8,844	43
Jefferson Davis Elec Coop., Inc.	1	18	0
Little River Electric Coop., Inc.	4	235	1
Lynches River Electric Coop., Inc.	3	167	0
Mid-Carolina Electric Coop., Inc.	6	227	1
Palmetto Electric Coop., Inc.	4	47	1
Pee Dee Electric Coop., Inc.	19	357	6
Santee Electric Coop., Inc.	22	999	12
South Carolina Public Service Authority	26	2,654	13
York Electric Coop., Inc.	26	1,166	8

DATA ABOUT SOUTH CAROLINA'S MANUFACTURED HOME COMMUNITIES

Community Size

TABLE SC3: **Number of Manufactured Home Communities by Size**

Category Range (sites in community)	Category Count	% of Total Communities with Site Counts
Large: >100	**110**	**28.80%**
>500	9	
300–499	12	
100–299	89	
Medium: 50–99	**83**	**21.73%**
75–99	33	
50–74	50	
Small: 1-49	**189**	**49.48%**
25–49	82	
1–24	107	
Communities without Site Counts	**477**	
Total Number of Communities	**859**	

TABLE SC4: **Homesites by Community Size**

Community Size	Sites	% of Sites
Large	21,016	61.22%
Medium	4,975	14.49%
Small	8,340	24.29%
Total Sites	**34,331**	**100%**

Community Income

1. State Median Household Income — $53,199

TABLE SC5: **Communities in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
Community Count	428	218	471	297
Site Count	32,390	8,460	33,151	13,513
% of Sites	68.41%	17.87%	70.02%	28.54%
% of Total Communities	62.48%	31.82%	68.76%	43.36%

TABLE SC6: **Income by Community Size**

		Small	Medium	Large
LMI Communities (by CBSA)	Community Count	76	49	64
	Site Count	1,806	3,400	27,184
	% of Sites	39.58%	59.04%	58.18%
	% of Total Communities	19.90%	12.83%	16.75%
Low-Income Communities (by CBSA)	Community Count	36	22	29
	Site Count	892	1,567	6,001
	% of Sites	18.75%	26.51%	26.36%
	% of Total Communities	9.42%	5.76%	7.59%

2. Communities Restricted to Ages 55+

TABLE SC7: **Total Number of Communities with Age Restrictions**

Number of Age-Restricted Communities	Sites	Percent of All Communities	Percent of All Sites
27	3,156	3.14%	6.67%

TABLE SC8: **Age-Restricted Communities in LMI Census Tracts (by CBSA)**

	Small	Medium	Large
Total Number	**10**	**7**	**10**
LMI Communities	1	3	6
% of Age-Restricted Communities	3.70%	11.11%	22.22%
Low-income	**0**	**1**	**2**
% Age-Restricted Communities	0.00%	3.70%	7.41%

Texas

THE STATE'S MANUFACTURED HOUSING STOCK

According to the US Census Bureau, Texas has more manufactured homes (775,632) than any state, other than Florida. Slightly more than 7 percent of the state's housing stock is ma-nu-factured housing. Most manufactured homes are on privately owned individual plots of land. Informal subdivisions that include a large number of manufactured homes are common in Texas.

Texas has 2,553 manufactured home communities in the Datacomp database. The database has identified 185,642 homesites, which account for 23.8 percent as many houses as listed in the Census Bureau's counts. Only 13.5 percent of the communities in the database are missing homesite counts. Even though most manufactured homes in the state are not sited in communities, there are so many manufactured homes in total that the number in communities is large.

Most communities in the database are small, with fewer than 50 homesites. But because the large communities, by definition, have more homesites, most identified homesites (68.6 percent) are located in 523 large communities with over 100 homesites. There are 35 communities with more than 500 homesites.

Only 114, or 4.5 percent of the manufactured home communities have age restrictions. But those communities tend to be larger than average, so 14.7 percent of the homesites are in age-restricted communities.

Most communities and homesites in the Datacomp database are in a census tract that is low-income or moderate-income compared to the state median household income of $61,874. A somewhat lower share of communities and homesites are in LMI census tracts compared to the core-based statistical area (CBSA). This is unsurprising because Texas has an above-average state median income among the 14 states. It suggests that most communities and homesites are located in parts of the state that have many lower-income households. A rela-tively equal percentage of communities among the three different size categories are LMI.

Texas has had the largest market for new manufactured homes in recent years, with 15,866 shipped to the state in 2019. However, this remains a relatively small share of all new homes, because the amount of new construction overall is so large, with 129,094 building permits issued in 2019 for site-built, single-family homes—the most in the nation.[1]

1 US Census Bureau, "U.S. Manufactured Housing Shipments by State: 2019," *https://www2.census.gov/programs-surveys/mhs/visualizations/2019/2019usmapbystate.pdf*; US Census Bureau, "Building Permits Survey Annual Data," *https://www.census.gov/construction/bps/stateannual.html*.

TABLE TX1: **Texas Communities and Sites in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
% of Sites	53.18%	30.46%	66.60%	44.73%
% of Total Communities	56.10%	32.55%	70.73%	46.56%

There are manufactured home communities across many utility service territories, but unlike for most target states, researchers were unable to identify the service territories for most of the communities and homesites listed in the Datacomp database.

THE STATE'S SOLAR LANDSCAPE

Texas ranks second in the nation in solar capacity. The overwhelming majority of that is utility-scale, but there is still considerable residential capacity because the overall market for solar is so large. The residential market has been growing steadily since 2015.[2]

State Policies and Programs. Texas does not have a statewide net metering policy, but several municipalities and utilities offer net metering that credits owners for the electricity their solar panels produce. For example, residents in San Antonio, Brenham, Austin, and El Paso have possibilities for net metering and even some rebates.

Texas does not have a statewide community solar policy or program, but third-party developers and some utilities offer opportunities for community solar participation. The state also allows third-party ownership of residential PV installations.

Economics of a Typical PV System. The cost analysis of a 4-kW PV system suggests that the economics for solar in Texas falls in the middle of the 14 target states. One advantage is that installation costs are currently on the low side. However, significant new financial incentives would be necessary to help LMI homeowners pay for the upfront costs, or companies would need to be recruited to offer third-party owned systems at favorable prices for the solar market to grow.

Solar Industry Perspectives. A survey was sent to solar installers in Texas to assess their experience with manufactured homes and their perceptions of the potential for solar energy for manufactured housing. The primary obstacles identified were the difficulty of financing solar installations for LMI households and convincing potential lenders and solar customers that it can be affordable for these residents. One installer suggested including the cost of the installation of solar panels in the mortgage or loan financing. Another obstacle that was mentioned is the condition of the manufactured homes and the need to make sure that the roofs can withstand the structural loads from the solar panels. One installer raised the need for LMI residents to gain a more complete understanding of how solar energy works,

2 Solar Energy Industries Association, "Texas Solar" webpage, accessed March 23, 2020, *https://www.seia.org/state-solar-policy/texas-solar.*

3 National Rural Electric Cooperatives Association, Member Directory, *https://www.electric.coop/our-organization/nreca-member-directory.*

including the actual total costs that residents should anticipate, an explanation of net metering, and the role and responsibilities of utilities regarding a residential PV system.

Utility Programs and Perspectives. Texas has 67 rural electric cooperatives[3] and 76 municipal utilities,[4] ranking it first in the number of rural electric cooperatives and third in the number of municipal utilities in the nation. Some of the municipal utilities, especially Austin Energy, have been among the national leaders in promoting clean energy.

Texas Electricity Cooperatives (TEC) is a community of electric cooperatives headquartered in Austin, Texas. The organization currently includes 11 generation and transmission cooperatives, and 64 distribution cooperatives. Members of rural electric cooperatives in Texas are expressing their increasing desire to generate their own solar power, and most Texas cooperatives have established distributed generation programs. These cooperatives offer a range of approaches and their policies differ regarding billing procedures, incentives, and requirements.[5]

For example, Bartlett Electric Cooperative (BEC) in central Texas offers net metering for solar projects up to 20 kilowatts and credits any excess energy generated to the subsequent billing period, valuing the excess solar energy at the avoided cost rate. In January of each year, if any excess electricity remains from the previous 12 months, BEC credits the member for the excess at the wholesale rate. The cooperative does not charge any solar-specific monthly fee.[6]

Mid-South Synergy, a cooperative in southeast Texas, offers net metering for solar systems up to 30 kilowatts and credits excess generation at the retail rate. No solar-related extra fees are charged.[7] In south central Texas, Pedernales Electric Cooperative (PEC), one of the largest electric cooperatives in the US, offers net metering for solar installations up to 50 kilowatts. PEC credits members for excess energy generated at the avoided cost rate and has no solar-related fees. PEC also offers its members loans and on-bill financing for the installation of solar panels.[8]

Additionally, some Texas rural electric cooperatives and municipal utilities are creating local community solar programs and offering members subscriptions to the energy produced from those arrays. Cooperatives and municipal utilities are well-suited to launch community solar programs because of their flexibility to respond to member demand and because there are no state regulations prohibiting community solar arrays.

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4 *American Power Association, "We are Community Powered, Find your Utility, Find your City," https://wearecommunitypowered.com.*

5 Ross Pomfrey and Ron Zagari. "Solar Energy and Texas Electric Cooperatives," (2016), *https://txses.org/solar-energy-and-electric-co-ops.*

6 Bartlett Electric Company, Distributed Generation, Tariff, *https://www.bartlettec.coop/wp-content/uploads/2020/07/DG-Tariff-7-30-2020.pdf.*

7 Mid-South Synergy, *https://midsouthelectric.com/midsouthsolarenergy.*

8 Pedernales Electric Cooperative, *https://www.pec.coop/your-service/solar-option.*

RECOMMENDATIONS

The market in Texas for new manufactured homes is quite large, so that is one logical focus for moving solar forward. It would be desirable to undertake efforts to ensure that house purchasers have an option to buy a solar-ready manufactured home and to purchase a rooftop system that can be included in the financing of the home.

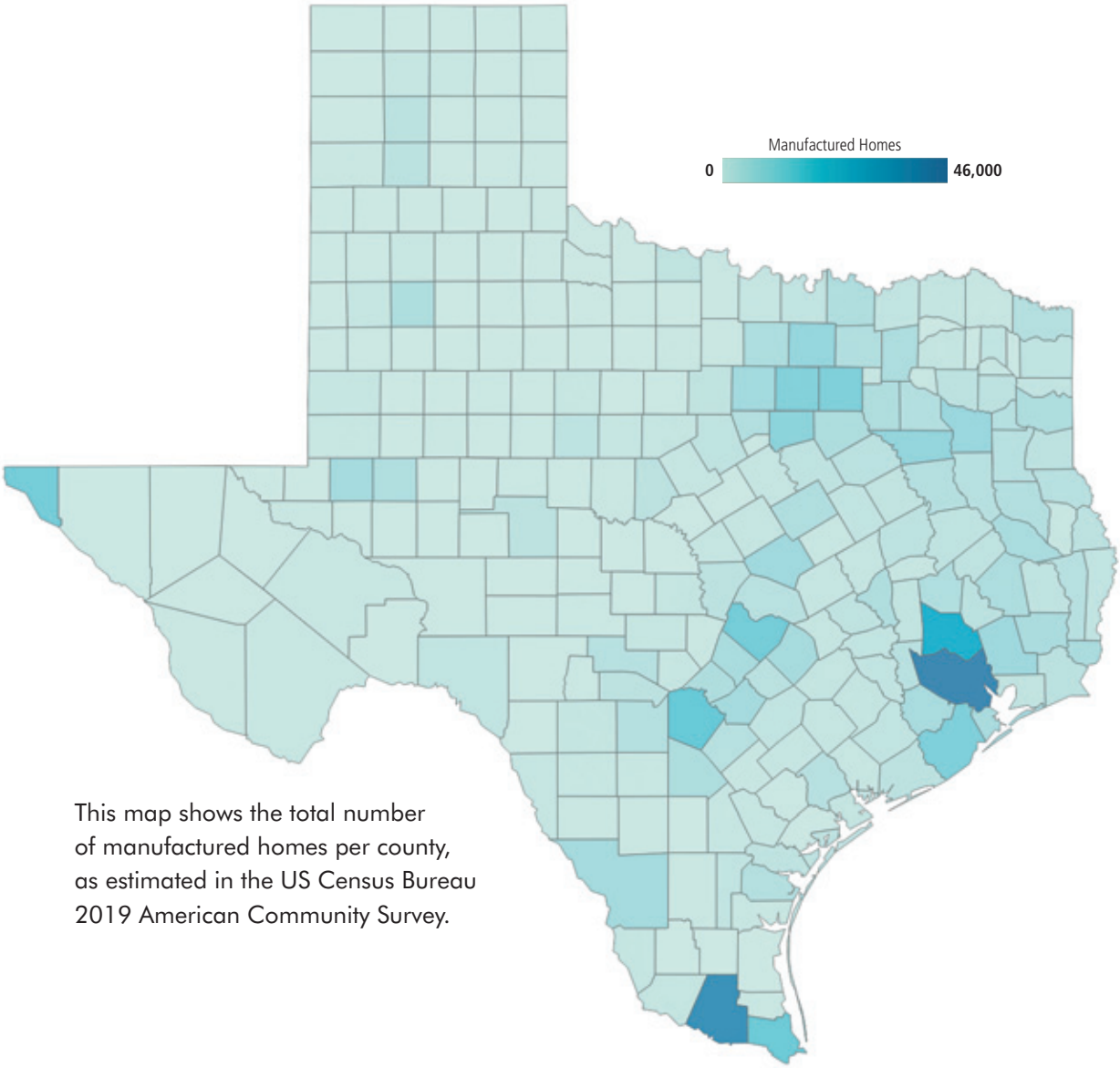
Beyond that, pilot programs for existing manufactured home residents in one or a few locations would help build awareness about the benefits of solar. The key to offering such pilot programs would be finding willing partners to provide some funding, or to leverage financing that can enable projects to be cash-flow positive for the residents. It might make sense to see if any of the utilities that already offer on-bill financing or have developed community solar would be interested in embracing solar for manufactured home communities, as a way to alleviate poverty and reduce delinquent bill payments.

A pilot initiative could take one of several forms. There are so many large manufactured home communities in Texas that one or more of them could be the focus of a pilot. A marketing campaign could be efficient if it used the community's homeowners association and other mechanisms for disseminating information within the community. A Solarize-style campaign could work well in such a setting—either seeking to offer a large number of identical rooftop, ground-mounted, or pole-mounted systems or seeking subscribers to a shared community solar project.

Alternatively, an initiative could focus on the numerous manufactured homes that are in informal subdivisions. In that case, the best strategy could be a Solarize-type campaign aimed at all LMI single-family homes in a specific geographic area composed of one or more subdivisions, not just manufactured homes. If the goal is to bring solar to LMI homeowners, there would not be a reason to exclude LMI houses that are not manufactured homes. But the technology solutions offered would need to work with both manufactured homes and site-built homes.

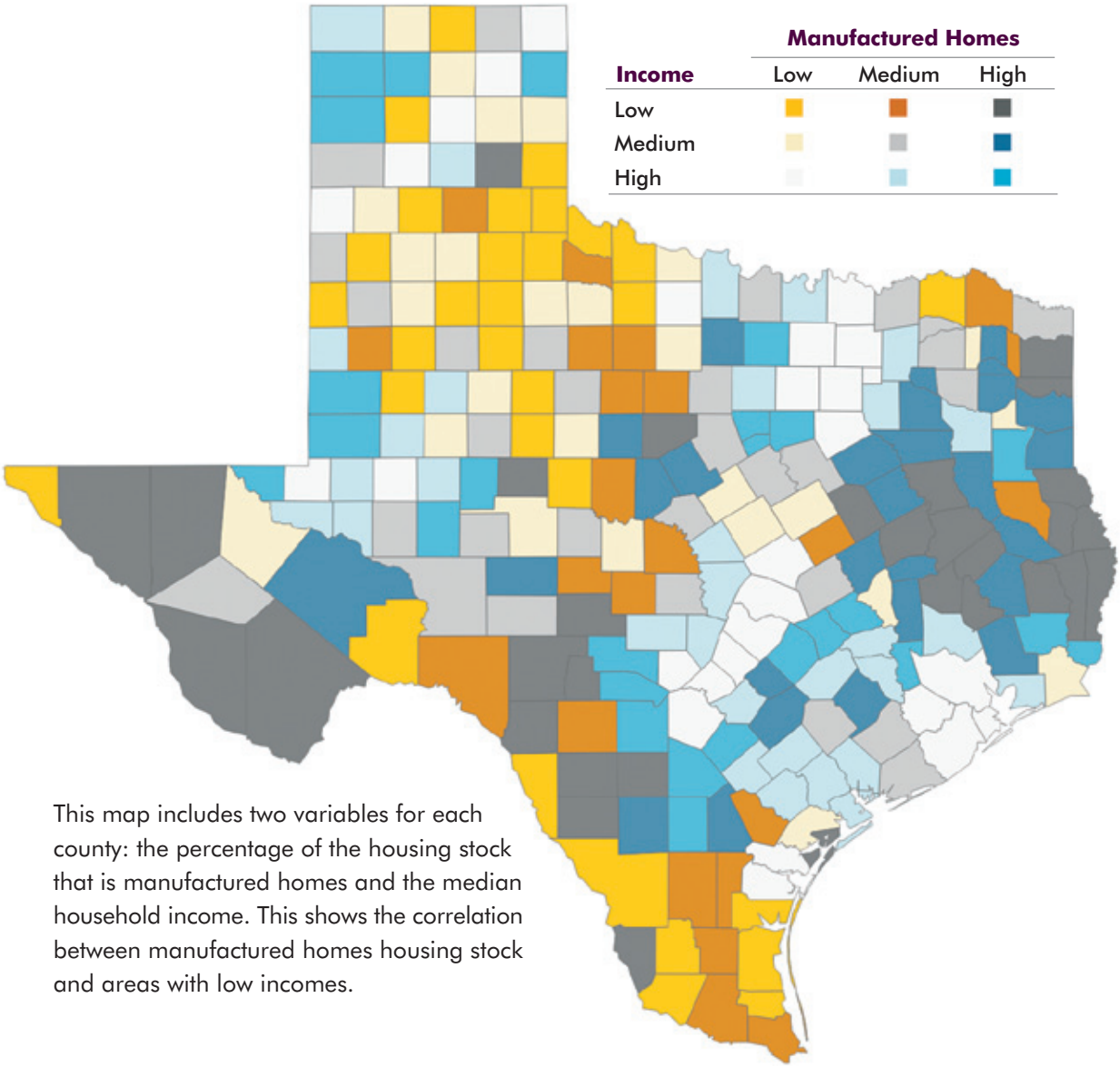
THE GEOGRAPHY OF TEXAS' MANUFACTURED HOMES

FIGURE TX1: **Total Manufactured Homes**



This map shows the total number of manufactured homes per county, as estimated in the US Census Bureau 2019 American Community Survey.

FIGURE TX2: **Manufactured Homes vs. Household Income**



This map includes two variables for each county: the percentage of the housing stock that is manufactured homes and the median household income. This shows the correlation between manufactured homes housing stock and areas with low incomes.

TABLE TX2: **Communities and Homesites by Utility**

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Austin Energy	66	7,307	48
Bandera Electric Coop., Inc.	13	571	4
Bartlett Electric Coop., Inc.	75	4,768	34
Big Country Electric Coop., Inc.	1	200	0
Bluebonnet Electric Coop., Inc.	26	997	13
Bowie-Cass Electric Coop., Inc.	3	27	0
Brownsville Public Utilities Board	14	1,481	2
Central Texas Elec Coop., Inc.	27	1,600	10
City of Bastrop, Texas (Utility Co.)	1	9	1
City of Brenham, Texas (Utility Co.)	1	21	0
City of Bridgeport, Texas (Utility Co.)	1	21	1
City of Bryan, Texas (Utility Co.)	19	1,387	4
City of Castroville, Texas (Utility Co.)	1	10	0
City of Coleman, Texas (Utility Co.)	1	12	0
City of College Station, Texas (Utility Co.)	3	208	1
City of Cuero, Texas (Utility Co.)	1	12	0
City of Denton, Texas (Utility Co.)	3	40	2
City of Farmersville, Texas (Utility Co.)	2	25	1
City of Floresville, Texas (Utility Co.)	1	59	0
City of Fredericksburg, Texas (Utility Co.)	1	1	0
City of Garland, Texas (Utility Co.)	1	16	1
City of Hemphill, Texas (Utility Co.)	1	14	0
City of Hempstead, Texas (Utility Co.)	1	5	0
City of La Grange, Texas (Utility Co.)	1	83	0
City of Lexington, Texas (Utility Co.)	1	18	0
City of Livingston, Texas (Utility Co.)	1	300	0
City of Lockhart, Texas (Utility Co.)	1	1	0
City of Lubbock, Texas (Utility Co.)	4	366	2
City of Moulton, Texas (Utility Co.)	1	1	0
City of New Braunfels, Texas (Utility Co.)	2	125	0
City of Robstown, Texas (Utility Co.)	2	7	0
City of San Antonio, Texas (Utility Co.)	100	11,153	61
City of San Marcos, Texas (Utility Co.)	1	6	0
City of Seguin, Texas (Utility Co.)	2	107	1
City of Shiner, Texas (Utility Co.)	1	9	0
City of Tulia, Texas (Utility Co.)	1	21	0

TABLE TX2: **Communities and Homesites by Utility** (CONTINUED)

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Comanche County Electric Coop. Association	1	1	1
Deep East Texas Electric Coop., Inc.	1	26	0
Denton County Electric Coop., Inc.	61	6,505	36
El Paso Electric Co.	104	5,533	50
Entergy Texas, Inc.	171	6,383	64
Fannin County Electric Coop.	2	65	1
Farmers Rural Electric Coop. Corp.	7	247	5
Fayette Electric Coop., Inc.	8	401	0
Georgia Power Co.	2	69	0
Grayson-Collin Electric Coop., Inc.	33	2,964	20
Guadalupe Valley Electric Coop., Inc.	24	1,147	9
Hamilton County Electric Coop. Association	2	511	1
Heart of Texas Electric Coop.	84	5,010	36
HILCO Electric Coop., Inc.	2	372	0
Hydro One Networks, Inc.	1	24	0
Intercounty Electric Coop. Association	1	27	0
Jasper-Newton Electric Coop., Inc.	5	163	0
Karnes Electric Coop., Inc.	3	72	0
Lamar County Elec Coop. Association	1	15	0
Lyntegar Electric Coop., Inc.	1	1	0
Madison Gas & Electric Co.	1	6	0
Magic Valley Electric Coop., Inc.	20	4,131	3
Medina Electric Coop., Inc.	5	706	2
Mid-South Electric Coop. Association	72	4,682	29
North Plains Electric Coop., Inc.	1	12	0
Pedernales Electric Coop., Inc.	71	3178	32
Public Service Company of Oklahoma	2	77	0
Puget Sound Energy, Inc.	1	12	0
Red River Valley Coop Power Association	1	215	0
Rio Grande Electric Coop., Inc.	2	21	0
Rita Blanca Electric Coop., Inc.	1	11	0
Sam Houston Electric Coop., Inc.	6	776	0
Sharyland Utilities, LP	17	1,446	2
South Plains Electric Coop., Inc.	8	245	2
Southwestern Electric Power Co.	88	3,152	18

TABLE TX2: **Communities and Homesites by Utility** (CONTINUED)

Utility	Total Communities	Total Sites	LMI Communities by CBSA
Southwestern Public Service Co.	86	4,648	37
Texas-New Mexico Power Co.	91	3,829	54
Tri-County Electric Member Corp.	13	293	5
Trinity Valley Elec Coop., Inc.	3	68	0
United Electric Coop Service, Inc.	6	198	1
Upshur Rural Elec Coop. Corp.	1	5	0
Wise Electric Coop., Inc.	12	521	4
Wood County Electric Coop., Inc.	1	300	0

DATA ABOUT TEXAS' MANUFACTURED HOME COMMUNITIES

Community Size

TABLE TX3: **Number of Manufactured Home Communities by Size**

Category Range (sites in community)	Category Count	% of Total Communities with Site Counts
Large: >100	**523**	**23.68%**
>500	35	
300–499	83	
100–299	405	
Medium: 50–99	**419**	**18.97%**
75–99	127	
50–74	292	
Small: 1-49	**1,267**	**57.36%**
25–49	580	
1–24	687	
Communities without Site Counts	**344**	
Total Number of Communities	**2,553**	

TABLE TX4: **Homesites by Community Size**

Community Size	Sites	% of Sites
Large	127,366	68.61%
Medium	28,215	15.20%
Small	30,061	16.19%
Total Sites	**185,642**	**100%**

Community Income

1. State Median Household Income — $61,874

TABLE TX5: **Communities in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
Community Count	1,265	734	1,595	1,050
Site Count	98,727	56,538	123,642	83,033
% of Sites	53.18%	30.46%	66.60%	44.73%
% of Total Communities	56.10%	32.55%	70.73%	46.56%

TABLE TX6: **Income by Community Size**

		Small	Medium	Large
LMI Communities (by CBSA)	Community Count	582	223	298
	Site Count	14,397	15,201	69,129
	% of Sites	45.94%	53.22%	56.98%
	% of Total Communities	26.35%	10.10%	13.49%
Low-Income Communities (by CBSA)	Community Count	344	120	176
	Site Count	8,548	8,271	39,719
	% of Sites	27.15%	28.64%	33.65%
	% of Total Communities	15.57%	5.43%	7.97%

2. Communities Restricted to Ages 55+

TABLE TX7: **Total Number of Communities with Age Restrictions**

Number of Age-Restricted Communities	Sites	Percent of All Communities	Percent of All Sites
114	27,366	4.47%	14.74%

TABLE TX8: **Age-Restricted Communities in LMI Census Tracts (by CBSA)**

	Small	Medium	Large
Total Number	**21**	**13**	**75**
LMI Communities	11	7	45
% of Age-Restricted Communities	9.65%	6.14%	39.47%
Low-income	**3**	**1**	**19**
% Age-Restricted Communities	2.63%	0.88%	16.67%

Virginia

THE STATE'S MANUFACTURED HOUSING STOCK

Virginia has 179,512 manufactured homes, according to the US Census Bureau, representing 5.1 percent of the state's housing stock. Most of these homes are on privately owned individual plots of land rather than in manufactured home communities.

The Datacomp database has identified 571 manufactured home communities with 41,276 homesites, which accounts for 22.8 percent as many houses as in the Census Bureau's counts. Although Datacomp's database is likely incomplete and 182 of the communities in the database do not include a count of homesites, it is clear that most manufactured homes in Virginia are located outside of manufactured home communities.

Those communities with site counts span a range of sizes, with the largest share being small communities with fewer than 49 sites. But because the large communities, by definition, have more homesites, most homesites (71.3 percent) are in the 116 large communities with over 100 homesites. Only eight communities have more than 500 homesites. Virginia has the smallest percentage of age-restricted communities (2.3 percent) of any of the 14 target states.

A high percentage of the communities in the Datacomp database are in a census tract that is low-income or moderate-income compared to the state median household income. That is unsurprising because, at $72,755, Virginia has the second highest median income of the 14 states. On the other hand, Virginia has lower proportions of LMI communities and sites compared to the core-based statistical area (CBSA). This emphasizes that most communities and sites are in relatively low-income parts of the state. Large communities are more likely than smaller ones to be in LMI census tracts, whether measured by the CBSA or the state median income.

Relatively few new manufactured homes have been sold in Virginia recently, with only 1,101 shipped to market in the state in 2019. This is a small share of all new homes, given that 21,056 building permits were issued in 2019 for site-built, single-family homes.[1]

Nearly half the communities and sites in the Datacomp database are in the service territory of investor-owned utility Dominion Power. The remainder are spread widely across a large number of utilities, with the largest clusters in the territories of Appalachian Power and Rappahannock Electric Coop. But given that most manufactured housing in Virginia is not

1 US Census Bureau, "U.S. Manufactured Housing Shipments by State: 2019," *https://www2.census.gov/programs-surveys/mhs/visualizations/2019/2019usmapbystate.pdf*; US Census Bureau, "Building Permits Survey Annual Data," *https://www.census.gov/construction/bps/stateannual.html*.

TABLE VA1: **Virginia Communities and Sites in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
% of Sites	56.10%	34.74%	69.16%	37.78%
% of Total Communities	47.68%	21.52%	81.66%	60.39%

located in communities but on individual plots of land, there are undoubtedly large numbers of manufactured homes in the service territories of many utilities.

THE STATE'S SOLAR LANDSCAPE

Virginia's total solar capacity is roughly comparable to its population, ranking 11th among states. The number of residential installations has grown sharply since 2017, and Governor Ralph Northam has been a strong proponent of clean energy.

State Policies and Programs. In April 2020, Governor Northam signed the *Virginia Clean Economy Act* (SB 851, HB1526) and additional clean energy laws that advance renewable energy generation, including solar energy. The Act loosens restrictions on net metering and contains a mandatory renewable portfolio standard (RPS) that requires the state's two main investor-owned utilities, Dominion Energy and Appalachian Power, to obtain an increasing share of their electricity from renewable energy and ultimately become carbon free. The Act mandates that Dominion Energy procure at least 1 percent of its annual electricity for renewable portfolio standard compliance from distributed generation facilities. It also requires that at least one-quarter of such distributed generation be obtained from low-income qualifying projects. The law defines a low-income qualifying project as "a project that provides a minimum of 50 percent of the respective electric output to low-income utility customers."[2] Dominion Energy has submitted a proposal to the State Corporation Commission for how to comply with its RPS obligations, including the low-income obligations, and the Commission is assessing the proposal through a pending proceeding.[3]

In 2019, the Virginia General Assembly passed HB 2741, which created a Clean Energy Advisory Board (CEAB) and directed it to work with the Virginia Department of Mines, Minerals and Energy (DMME) to "establish a pilot program for disbursing loans or rebates for the installation of solar energy infrastructure in low-income and moderate-income households." Through this legislation, the General Assembly designated a special non-reverting fund in the state treasury for LMI solar program financing.[4] CEAB was initially convened in 2020 and is working to advance an LMI solar pilot program.[5] DMME has received approval to re-purpose approximately $200,000 in federal American Recovery and Reinvestment Act (ARRA) funds

2 Virginia's Legislative Information System, "HB 1526," accessed April 9, 2021, *https://lis.virginia.gov/cgi-bin/legp604.exe?201+sum+HB1526.*

3 State Corporation Commission, Case No. PUR-2020-00134, accessed April 9, 2021.

4 Virginia's Legislative Information System, "HB 2741," accessed April 9, 2021, *https://lis.virginia.gov/cgi-bin/legp604.exe?191+sum+HB2741.*

5 Virginia Department of Mines, Minerals and Energy, "Clean Energy Advisory Board, accessed April 9, 2021, *https://www.dmme.virginia.gov/de/CleanEnergyAdvisoryBoard2019.shtml.*

to support the LMI solar pilot. In 2020, the General Assembly passed HB 1707, which repealed a 2022 sunset provision for CEAB and added additional members to it.[6]

Separate from the LMI solar pilot program being developed by DMME in consultation with CEAB, HB 2789, enacted in 2019, ordered Dominion Energy and Appalachian Power to develop their own pilot programs with solar and energy efficiency incentives for low-income, elderly, and disabled customers.[7] In December 2020, Dominion Energy petitioned the State Corporation Commission to offer a solar program under HB 2789 for a three-year period starting in January 2022, with a total proposed budget of $31.1 million. Under the program, three- to five-kilowatt rooftop or pole-mounted solar systems would be installed for qualifying residential customers at no cost to them. Dominion Energy's solar program proposal under HB 2789 is pending before the State Corporation Commission.[8]

During the 2020 legislative session, Governor Northam signed a bill, SB 754, that permits electric cooperatives in Virginia to create an on-bill tariff program. Electric cooperatives that choose to implement such a program will give their members the opportunity to undertake energy efficiency measures to lower their monthly energy usage and costs. Members will repay the cost of adopting these measures over a period of years as an "energy savings charge" line item on their utility statement, with the charge being assigned to the electric meter rather than to them personally if they move.[9] The bill requires that a stakeholder process be created to design the on-bill program, and that the stakeholder process "shall include an opportunity to participate for low-income and middle-income advocates, energy efficiency advocates, affordable housing advocates, and the staff of the [State Corporation] Commission."[10]

During the 2020 legislative session, the Virginia General Assembly also passed SB 629, which ordered the State Corporation Commission to establish a shared solar program for Dominion Energy customers in Virginia. The statute allows Dominion Energy customers to subscribe to a shared solar facility for the amount of electricity generated by it.[11] In December 2020, the State Corporation Commission issued shared solar program rules. Under the rules, the size of the shared solar program must not exceed 150 megawatts, at least 30 percent of which must be apportioned to low-income customers. Each entity operating or owning a shared solar facility must demonstrate that it meets the low-income customer requirement.

After the program's 30 percent low-income requirement is satisfied, the program will be expanded to a cumulative total of 200 megawatts. Generally, Dominion Energy customers will be subject to a minimum bill requirement to subscribe to a shared solar facility, but low-income customers are exempt from that provision. Dominion Energy is to begin accepting

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6 Virginia's Legislative Information System, "HB 1707," accessed April 9, 2021, *https://lis.virginia.gov/cgi-bin/legp604.exe?201+sum+HB1707*.

7 Virginia's Legislative Information System, "HB 2789," accessed April 9, 2021, *https://lis.virginia.gov/cgi-bin/legp604.exe?191+sum+HB2789*.

8 State Corporation Commission, Case No. PUR-2020-00274, accessed April 9, 2021, *https://scc.virginia.gov/docketsearch/DOCS/4q%24y01!.PDF*.

9 Environmental and Energy Study Institute. Virginia's Latest Session Is a Milestone for the State's Clean Energy Advocates. (June 18, 2020), *https://www.eesi.org/articles/view/virginias-latest-session-is-a-milestone-for-the-states-clean-energy-advocates*.

10 Code of Virginia. § 56-585.7. On-bill tariff program; electric cooperatives, *https://law.lis.virginia.gov/vacode/title56/chapter23/section56-585.7*.

11 Virginia's Legislative Information System, "SB 629," accessed April 9, 2021, *https://lis.virginia.gov/cgi-bin/legp604.exe?201+sum+SB629*.

applications for registration by July 1, 2021.[12] As part of a different proceeding, the State Corporation Commission has established rules for a separate shared solar program for residents of multifamily housing who are Dominion and Old Dominion Power Company customers.[13]

Economics of a Typical PV System. This project's analysis of typical costs for a 4-kW system in Virginia showed that larger financial incentives would be necessary to help LMI homeowners pay for the upfront costs of solar than in most of the 14 target states. Part of the reason for this is that Virginia has the 7th lowest electricity costs in the nation. In addition, residential solar installers are not currently offering solar lease products in Virginia, and residential solar power purchase agreements are limited. Absent widespread third-party solar system ownership options, it is a daunting hurdle for LMI households to pay for the upfront cost of a system.

Solar Industry Perspectives. A survey was sent to solar companies in Virginia to assess their experience with manufactured homes and their perception of the potential for solar for manufactured housing. The primary obstacle they identified was the need for improved financing options for LMI manufactured homeowners. One installer indicated that there were significant financing fees, sometimes over 15 percent of the system, causing insurmountable obstacles for affordability of the system. LMI customers have difficulty qualifying for traditional financing, because of insufficient credit scores, a high debt-to-income ratio, or a low level of income. A second obstacle that was mentioned is that many residents of manufactured homes do not own the property on which their home is located. Additional obstacles were the extra work involved in marketing to potential customers with limited familiarity with solar and in obtaining information that the solar installers needed to proceed with an installation on a manufactured home, such as professional engineering drawings.

Utility Programs and Perspectives. Dominion Energy and Appalachian Power have become more engaged in solar development as it has become a priority for state policymakers. Virginia also has 13 rural electric cooperatives and 16 municipal utilities, some of which have taken steps to advance solar. For example, in 2017, Shenandoah Valley Electric Cooperative, serving the northern and central Shenandoah Valley, responded to members' requests for greater opportunities for solar by highlighting a range of solar technologies at its headquarters and demonstrating potential solar options for its members.[14] The BARC Electric Cooperative, serving members in Bath, Allegheny, and Rockbridge Counties, responded to members' interests in community solar with a 550-kW community solar project in 2016, the first community solar project in Virginia.[15]

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12 State Corporation Commission, Case No. PUR-2020-00125, accessed April 9, 2021, *https://scc.virginia.gov/docketsearch/DOCS/4qxr01!.PDF.*

13 State Corporation Commission, Case No. PUR-2020-00124, accessed April 9, 2021, *https://scc.virginia.gov/docketsearch/DOCS/4qxq01!.PDF.*

14 Solar United Neighbors. Shenandoah Valley Electric Cooperative member energizes push for solar. (June 23, 2017), *https://www.solarunitedneighbors.org/news/shenandoah-valley-electric-cooperative-member-energizes-push-for-solar.*

15 Delman, Ben. A look at Virginia's first community solar effort. (May 31, 2016), Solar United Neighbors, *https://www.solarunitedneighbors.org/news/a-look-at-virginias-first-community-solar-effort.*

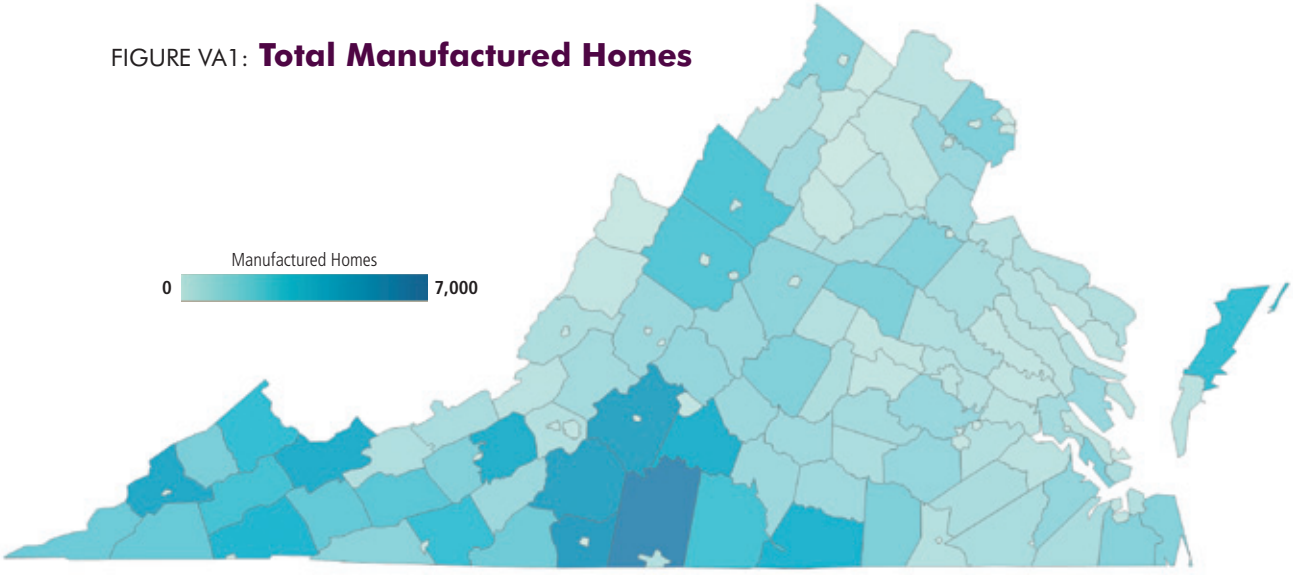
RECOMMENDATIONS

Any efforts to bring solar to manufactured homes on a large scale would require major new funding. But the clean energy policy initiatives underway create opportunities for pilot projects and for laying the groundwork for larger efforts in the future. In particular:

- DMME and the Clean Energy Advisory Board could include manufactured homes in the pilot LMI project they are designing, so that they gain experience with installations for manufactured homes. That could make it possible to include manufactured homes when DMME ultimately rolls out a larger initiative.
- The pilot programs that Dominion Energy and Appalachian Power are developing for offering solar and energy efficiency incentives to low-income, elderly, and disabled customers should include manufactured homes residents. A pilot program that enables the installation of fully subsidized small rooftop or pole-mounted solar systems for residential customers, as proposed by Dominion, could be well-suited for residents of manufactured homes. As Dominion Energy and Appalachian Power continue to expand solar development, they can undertake additional pilot projects for manufactured homes.
- Shared solar subscriptions under SB 629 should be made available to residents of manufactured homes in a manner that ensures low-income subscribers benefit financially from their subscriptions. Manufactured housing residents could make up a substantial portion of the program's low-income subscriber carve-out.
- Electric coops should be encouraged to include solar as an eligible "energy efficiency" technology when they launch on-bill tariff programs. They can augment those programs with additional incentives to alleviate poverty for manufactured home residents and to reduce delinquent bill payments.
- Policymakers could clarify and expand the availability of third-party ownership for residential solar.

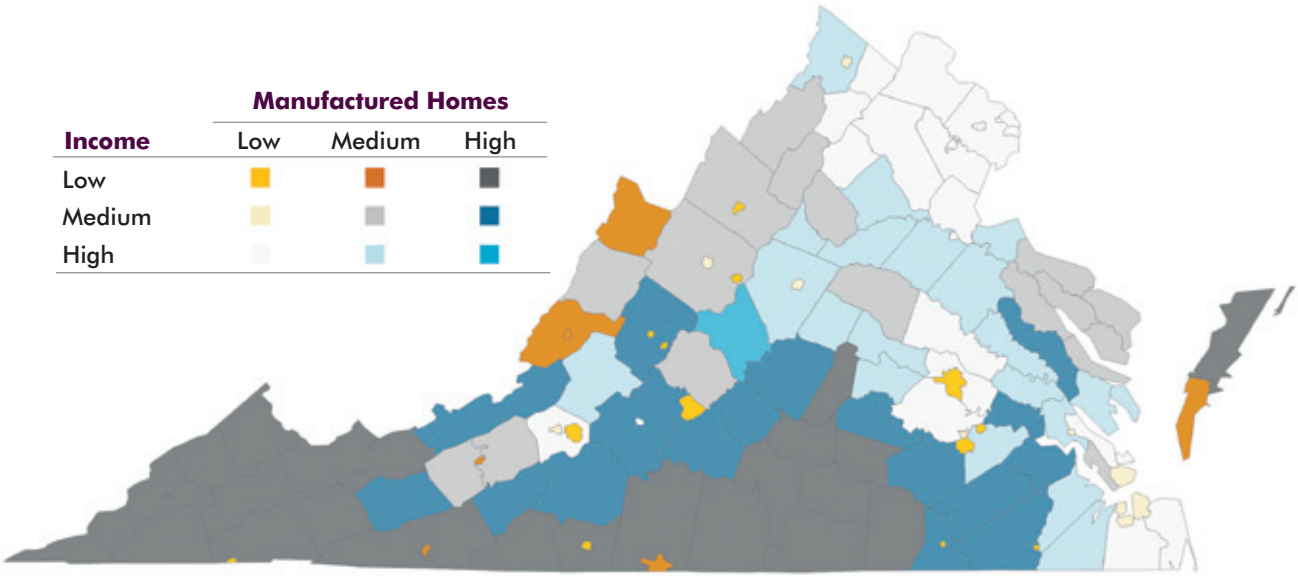
THE GEOGRAPHY OF VIRGINIA'S MANUFACTURED HOMES

FIGURE VA1: **Total Manufactured Homes**



This map shows the total number of manufactured homes per county, as estimated in the US Census Bureau 2019 American Community Survey.

FIGURE VA2: **Manufactured Homes vs. Household Income**



This map includes two variables for each county: the percentage of the housing stock that is manufactured homes and the median household income. This shows the correlation between manufactured homes housing stock and areas with low incomes.

TABLE VA2: **Communities and Homesites by Utility**

Utility	Total Communities	Total Sites	LMI Communities by CBSA
A & N Electric Coop. (Virginia)	6	217	0
Appalachian Power Co.	186	6,795	40
BARC Electric Coop., Inc.	2	73	0
Bristol Virginia Utilities	2	71	0
Carroll Electric Coop. Corp.	1	105	0
Central Virginia Electric Coop.	2	53	0
City of Danville, Virginia (Utility Co.)	1	1	0
City of Manassas, Virginia (Utility Co.)	3	112	2
City of Salem, Virginia (Utility Co.)	4	356	2
Community Electric Coop.	10	541	6
Dominion Energy	244	19,192	121
Kentucky Utilities Co.	21	542	3
Mecklenburg Electric Coop., Inc.	10	593	1
Northern Neck Electric Coop., Inc.	4	286	0
Northern Virginia Electric Coop.	5	905	4
Old Dominion Power Co.	21	542	3
Prince George Electric Coop.	4	346	1
Rappahannock Electric Coop.	27	9,114	7
Shenandoah Valley Electric Coop.	28	1,551	8
Southside Electric Coop., Inc.	3	43	0
Taylor County Rural Electric Coop. Corp.	1	12	0
Tennessee Valley Authority (Mississippi)	56	1,521	7
Town of Elkton, Virginia (Utility Co.)	1	40	0

DATA ABOUT VIRGINIA'S MANUFACTURED HOME COMMUNITIES

Community Size

TABLE VA3: **Number of Manufactured Home Communities by Size**

Category Range (sites in community)	Category Count	% of Total Communities with Site Counts
Large: >100	**116**	**29.82%**
>500	8	
300–499	9	
100–299	99	
Medium: 50–99	**109**	**28.02%**
75–99	33	
50–74	76	
Small: 1-49	**164**	**42.61%**
25–49	92	
1–24	72	
Communities without Site Counts	**182**	
Total Number of Communities	**571**	

TABLE VA4: **Homesites by Community Size**

Community Size	Sites	% of Sites
Large	29,413	71.26%
Medium	7,404	17.94%
Small	4,459	10.80%
Total Sites	**41,276**	**100%**

Community Income

1. State Median Household Income — $74,222

TABLE VA5: **Communities in LMI Census Tracts**

	LMI (by CBSA)	Low-Income (by CBSA)	LMI (State)	Low-Income (State)
Community Count	195	88	334	247
Site Count	23,155	14,339	28,548	15,596
% of Sites	56.10%	34.74%	69.16%	37.78%
% of Total Communities	47.68%	21.52%	81.66%	60.39%

TABLE VA6: **Income by Community Size**

		Small	Medium	Large
LMI Communities (by CBSA)	Community Count	34	25	66
	Site Count	991	1,716	20,448
	% of Sites	20.73%	22.94%	56.90%
	% of Total Communities	8.74%	6.43%	16.97%
Low-Income Communities (by CBSA)	Community Count	10	11	32
	Site Count	257	676	13,406
	% of Sites	6.10%	10.09%	27.59%
	% of Total Communities	2.57%	2.83%	8.23%

2. Communities Restricted to Ages 55+

TABLE VA7: **Total Number of Communities with Age Restrictions**

Number of Age-Restricted Communities	Sites	Percent of All Communities	Percent of All Sites
13	615	2.28%	1.49%

TABLE VA8: **Age-Restricted Communities in LMI Census Tracts (by CBSA)**

	Small	Medium	Large
Total Number	**9**	**3**	**1**
LMI Communities	1	2	1
% of Age-Restricted Communities	7.69%	15.38%	7.69%
Low-income	**1**	**2**	**0**
% Age-Restricted Communities	7.69%	15.38%	0.00%

APPENDIX A

Residential PV System Costs in Target States

To get an indication of the financial costs and benefits of installing residential PV systems at or on manufactured homes in the 14 target states examined in this report, researchers for this report developed cost and electricity savings analyses for a typical system in each of those states. The methodology was developed by Autumn Proudlove and Brian Lips of the North Carolina Clean Energy Technology Center, and they calculated the results.

THE CHOSEN SCENARIOS

The researchers determined the cost of a 4-kilowatt system located in the largest city served by an investor-owned utility in each state and then examined four different scenarios for financing such a system without any new special incentives for LMI solar at manufactured homes. Three of the four scenarios involved 15-year market-rate loans at 4.74 percent, described below:

1. A homeowner who takes out a loan and then claims the federal investment tax credit and any applicable state credit at the end of the year.
2. A homeowner who takes out a smaller loan that does not include the value of the tax credits. For example, the homeowner has savings or another way to pay for part of the system upfront and then receives the tax credits at the end of the year.
3. A homeowner who is unable to take advantage of the federal tax credit or any applicable state tax credit.

The three market-rate loan scenarios were compared to a scenario in which the homeowner enters into a market-rate 25-year lease.

To begin to understand the level of special state incentives that might be needed to make LMI solar for manufactured homes financially beneficial for the residents, researchers modeled two possible special incentives for each of the loan scenarios, but not for the lease scenario:

1. A buy-down of the interest rate from 4.74 percent to 2 percent. This would cost a state, utility, or other entity offering this incentive approximately $1,800 to $4,000 depending upon the state and the scenario.
2. An upfront cash payment that reduces the system cost by $5,000.

1 Galen Barbose and Naim Dargouth, *Tracking the Sun: Pricing and Design Trends for Distributed Photovoltaic Systems in the United States, 2019 Edition* (Lawrence Berkeley National Laboratory, October 2019), p. 10, *https://emp.lbl.gov/sites/default/files/tracking_the_sun_2019_report.pdf*.

To determine the extent to which system size drives the economics of the installations, we also analyzed 6.4-kilowatt PV systems at the same locations as the 4-kilowatt system in Virginia and South Carolina. Some manufactured homes have a sufficient electricity load to be able to use a system of this size, which was the median size for all residential systems installed in the US in 2018, according to Lawrence Berkeley National Laboratory's *Tracking the Sun* report,[1] and is coincidentally also the median size for the systems installed on LMI single-family homes through the Connecticut Green Bank's Solar for All Program.

The results from the economic analyses for the 14 target states examined in this report are summarized in Table APP-A1. Additional information about the methodology used is included at the end of this appendix.

LIMITATIONS OF THE ANALYSIS

We conducted this analysis to get a general sense of the economics of solar for LMI residents of manufactured homes. The results are useful and can help to determine how a state, utility, or solar company might want to proceed with crafting programs and system offerings for those residents. However, we realize that there are significant limitations to any analysis based on a single illustrative system in a state. Among the factors that could lead to different results for a specific manufactured homes community are the following:

1. Electricity rates and system costs could be different in a location other than the one examined.
2. Some manufactured homes may not need a system as large as 4 kilowatts.
3. Some rooftops will not support a PV system, and a ground-mounted or a pole-mounted system could be more expensive.
4. Because solar lease cost data is typically not published publicly, our solar lease scenarios may not represent the solar leasing deals actually being offered in the state.

KEY FINDINGS

Because of variations in states' solar resources, solar markets, and solar policies, there are significant differences in the economics of solar for manufactured homes in different states. Nevertheless, we can make some general statements about the results of the analysis.

Initial negative cash flow from taking out a market-rate loan to finance a system is a large hurdle for LMI homeowners to install solar. In almost all states assessed for this report, a homeowner who qualifies for the federal investment tax credit and installs solar would ultimately save money on a system, even with a market-rate loan. However, except for California, homeowners who rely on a market-rate loan would not save money during the first year they had a system, even if they qualify for the investment tax credit. The first-year cost could be quite significant, with first-year costs of $77 per month in Kentucky, for example.

2 Depending upon their income, some homeowners may be able to use part but not all of the federal investment tax credit, as well as part but not all of a state tax credit in those states that have a tax credit.

For homeowners who cannot fully take advantage of the investment tax credit,[2] the financial benefits from installing PV using a market-rate loan are worse. In seven states, average yearly cash flow is negative over 25 years. Five of the other seven states—all but Arizona and California—have minimal average positive cash flow over 25 years.

A lease could be a good option for some homeowners. Leasing companies usually structure the lease so that there is at least some savings in the first year. Researchers modeled a 25-year lease, which spreads out the financing over a longer period than a typical 15-year loan. That makes it easier to ensure immediate savings in year one, even if the average annual savings over 25 years may be less. Because the leasing company, rather than the homeowner, owns the PV system, it can take advantage of a federal solar tax credit even if the homeowner cannot. The results below for each state that allows third-party ownership of residential systems assumes a lease structure that is typical in residential solar markets. It starts with a 15 percent savings for the homeowner but has a 2.5 percent annual escalator. This will not necessarily yield savings for the homeowner in later years if the cost of electricity from the grid does not rise at a similar rate.

The results of the calculations of the costs and benefits of a typical PV system suggest that some sort of special program or incentives would be necessary to make solar appealing to a large number of residents of manufactured homes. The two options modeled—an interest rate buydown to 2 percent and a $5,000 rebate—each yields solid, average annual savings over 25 years in many states, with the $5,000 rebate having a bigger impact on customer savings. Nevertheless, neither incentive is sufficient in all states to overcome negative cash flow in the early years for homeowners who finance the system with a loan. These incentives could be sufficient to attract companies to offer leases via third-party ownership in many states, but outreach to solar companies would be necessary to learn whether they would be interested in entering the market under those circumstances.

In South Carolina and Virginia, the two states where a 6.4-kilowatt system was modeled, installing a larger system did not dramatically change the cost-benefit results.

TABLE APP-A1: **Summary of Economics for Solar by State**

Scenario	Year	AZ	CA	FL	GA	KY	ME	MI	MO	NM	NC	OH	SC	TX	VA
Market Rate Loan (4.74%) without Special State Incentives															
Loan for homeowner who qualities for federal tax credit	Year One		$3.97												
	25-Year Average	$36.55	$89.16	$11.97	$11.74		($7.24)	$4.64	$17.25	$19.99	$17.20	$5.06	$26.31	$10.36	$3.77
Loan with federal tax credit received and excluded from upfront cost	Year One	($3.13)	$29.22										($0.98)		
	25-Year Average	$42.71	$93.67	$16.73	$16.38	($5.63)	($2.75)	$10.44	$21.83	$26.77	$22.01	$10.11	$35.90	$15.21	$9.15
Loan with no federal or state tax credit	Year One		$3.97												
	25-Year Average	$21.88	$78.52	$0.64	$0.73			($9.08)	$1.47	$0.08	$5.90	($7.16)	$3.33	($1.02)	($8.03)
State Incentive: 2% Interest Rate															
Loan for homeowner who qualities for federal tax credit	Year One		$21.20												
	25-Year Average	$47.56	$99.50	$22.98	$22.43	$0.78	$3.15	$17.97	$27.14	$32.09	$26.15	$16.92	$37.68	$21.41	$15.22
Loan with federal tax credit received and excluded from upfront cost	Year One	$9.05	$41.95						($6.19)	($6.62)	($2.89)		$8.32		
	25-Year Average	$50.01	$101.31	$24.87	$24.29	$2.87	$4.94	$20.30	$28.94	$35.22	$28.10	$18.90	$41.48	$23.38	$17.55
Loan with no federal or state tax credit	Year One		$21.20												
	25-Year Average	$32.89	$88.86	$11.64	$11.42		($7.55)	$4.24	$12.20	$13.27	$14.85	$4.70	$14.71	$10.03	$3.42
State Incentive: $5,000 Rebate															
Loan for homeowner who qualities for federal tax credit	Year One	$1.60	$43.41						($4.63)		($0.44)				
	25-Year Average	$60.22	$112.83	$35.64	$35.40	$12.92	$16.42	$28.31	$40.92	$42.56	$40.86	$28.72	$49.97	$34.03	$27.43
Loan with federal tax credit received and excluded from upfront cost	Year One	$36.31	$68.66	$11.74	$10.59	($9.61)	($1.02)	($2.37)	$21.41	$18.73	$26.41	$3.53	$38.46	$10.74	$2.66
	25-Year Average	$66.37	$117.33	$40.39	$40.04	$18.03	$20.91	$34.10	$45.50	$50.43	$45.68	$33.77	$59.57	$38.88	$32.81
Loan with no federal or state tax credit	Year One	$1.60	$43.41						($4.63)		($0.44)				
	25-Year Average	$45.56	$102.18	$24.30	$24.39	$1.05	$5.73	$14.58	$29.87	$23.74	$29.57	$16.50	$27.00	$22.65	$15.63
Lease															

Note: The numbers in red are negative numbers.

Arizona

Typical Electric Bill and Solar Installation Impact

	Monthly Electric Bill without Solar	Monthly Electric Bill with Solar	Monthly Electric Bill Savings
Year One	$154.17	$88.83	$65.34
25-Year Average	$210.70	$126.91	$83.79

Financing Scenarios

Scenario	Monthly Loan Payment (first 15 years) or Lease Payment	Net Monthly Savings		Payback Period
Market Rate Loan (4.74%) without Special State Incentives				
Loan for homeowner who qualities for federal tax credit	$103.17	Year One	($37.83)	16 Years
		25-Year Average	$36.55	
Loan with federal tax credit received and excluded from upfront cost	$68.47	Year One	($3.13)	14 Years
		25-Year Average	$42.71	
Loan with no federal or state tax credit	$103.17	Year One	($37.83)	20 Years
		25-Year Average	$21.88	
State Incentive: 2% Interest Rate				
Loan for homeowner who qualities for federal tax credit	$84.83	Year One	($19.49)	13 Years
		25-Year Average	$47.56	
Loan with federal tax credit received and excluded from upfront cost	$56.29	Year One	$9.05	12 Years
		25-Year Average	$50.01	
Loan with no federal or state tax credit	$84.83	Year One	($19.49)	20 Years
		25-Year Average	$32.89	
State Incentive: $5,000 Rebate				
Loan for homeowner who qualities for federal tax credit	$63.74	Year One	$1.60	9 Years
		25-Year Average	$60.22	
Loan with federal tax credit received and excluded from upfront cost	$29.03	Year One	$36.31	7 Years
		25-Year Average	$66.37	
Loan with no federal or state tax credit	$63.74	Year One	$1.60	13 Years
		25-Year Average	$45.56	
Lease				
Lease (15% first year savings with 2.5% escalator)	Year One: $42.21	Year One	$23.13	N/A
	25-Year Average: $57.67	25-Year Average	$26.12	

Arizona CONTINUED

General Assumptions	Arizona-Specific Assumptions
Electricity Rates • 2.5% annual electricity price escalation **PV System** • 4 kW • 0.5% annual degradation rate **Loan and Lease Terms** • Loan: 15 years; no payments in years 16–25 • Lease: 25 years **Federal Incentive** • Federal ITC (26%) **Other** • 0% discount rate	**Location and Utility** • Phoenix • Arizona Public Service **PV System Cost** • $3.27 per watt **State Incentives** • State Tax Credit (25%, $1,000 max) • Property Tax Exemption • Sales Tax Exemption **Rate Tariff** • R-TOU-E • Fixed charge of $0.427/day. • Time-varying and seasonal rates ranging from 3.2 cents/kWh to 24.31 cents/kWh. • Tariff includes additional monthly charge of $0.93 per kW-DC of generation for customers with on-site generation. **Other** • Export credit rate is locked in for 10 years, but after that it changes to the current rate and may vary year to year

California

Typical Electric Bill and Solar Installation Impact

	Monthly Electric Bill without Solar	Monthly Electric Bill with Solar	Monthly Electric Bill Savings
Year One	$196.17	$95.33	$100.84
25-Year Average	$267.97	$131.33	$136.64

Financing Scenarios

Scenario	Monthly Loan Payment (first 15 years) or Lease Payment	Net Monthly Savings		Payback Period
Market Rate Loan (4.74%) without Special State Incentives				
Loan for homeowner who qualities for federal tax credit	$96.87	Year One	$3.97	11 Years
		25-Year Average	$89.16	
Loan with federal tax credit received and excluded from upfront cost	$71.62	Year One	$29.22	10 Years
		25-Year Average	$93.67	
Loan with no federal or state tax credit	$96.87	Year One	$3.97	13 Years
		25-Year Average	$78.52	
State Incentive: 2% Interest Rate				
Loan for homeowner who qualities for federal tax credit	$76.94	Year One	$21.20	9 Years
		25-Year Average	$99.50	
Loan with federal tax credit received and excluded from upfront cost	$58.89	Year One	$41.95	9 Years
		25-Year Average	$101.31	
Loan with no federal or state tax credit	$79.64	Year One	$21.20	11 Years
		25-Year Average	$88.86	
State Incentive: $5,000 Rebate				
Loan for homeowner who qualities for federal tax credit	$57.43	Year One	$43.41	6 Years
		25-Year Average	$112.83	
Loan with federal tax credit received and excluded from upfront cost	$32.18	Year One	$68.66	5 Years
		25-Year Average	$117.33	
Loan with no federal or state tax credit	$57.43	Year One	$43.41	8 Years
		25-Year Average	$102.18	
Lease				
Lease (15% first year savings with 2.5% escalator)	Year One: $51.80	Year One	$49.04	N/A
	25-Year Average: $70.77	25-Year Average	$65.87	

California CONTINUED

General Assumptions	California-Specific Assumptions
Electricity Rates • 2.5% annual electricity price escalation **PV System** • 4 kW • 0.5% annual degradation rate **Loan and Lease Terms** • Loan: 15 years; no payments in years 16–25 • Lease: 25 years **Federal Incentive** • Federal ITC (26%) **Other** • 0% discount rate	**Location and Utility** • Orange County • Southern California Edison **PV System Cost** • $3.07 per watt **State Incentives** • Property Tax Exemption • Sales Tax Exemption **Rate Tariff** • TOU-D-4-9PM • Fixed Charge: $0.031/day • Minimum Bill: $10.52/month • Time-Varying and Seasonal Rates ranging from 23.978 cents/kWh to 40.068 cents/kWh

Florida

Typical Electric Bill and Solar Installation Impact

	Monthly Electric Bill without Solar	Monthly Electric Bill with Solar	Monthly Electric Bill Savings
Year One	$113.58	$64.92	$48.66
25-Year Average	$155.19	$92.65	$62.54

Financing Scenarios

Scenario	Monthly Loan Payment (first 15 years) or Lease Payment	Net Monthly Savings		Payback Period
Market Rate Loan (4.74%) without Special State Incentives				
Loan for homeowner who qualities for federal tax credit	$103.17	Year One	$3.97	22 Years
		25-Year Average	$89.16	
Loan with federal tax credit received and excluded from upfront cost	$80.42	Year One	$29.22	20 Years
		25-Year Average	$93.67	
Loan with no federal or state tax credit	$103.17	Year One	$3.97	25 Years
		25-Year Average	$78.52	
State Incentive: 2% Interest Rate				
Loan for homeowner who qualities for federal tax credit	$84.83	Year One	($36.17)	17 Years
		25-Year Average	$22.98	
Loan with federal tax credit received and excluded from upfront cost	$66.17	Year One	($14.12)	17 Years
		25-Year Average	$24.87	
Loan with no federal or state tax credit	$84.83	Year One	($36.17)	22 Years
		25-Year Average	$11.64	
State Incentive: $5,000 Rebate				
Loan for homeowner who qualities for federal tax credit	$63.74	Year One	($15.08)	13 Years
		25-Year Average	$35.64	
Loan with federal tax credit received and excluded from upfront cost	$36.92	Year One	$11.74	11 Years
		25-Year Average	$40.39	
Loan with no federal or state tax credit	$63.74	Year One	($15.08)	17 Years
		25-Year Average	$24.30	
Lease				
Lease (15% first year savings with 2.5% escalator)	Year One: $31.62	Year One	$17.04	N/A
	25-Year Average: $43.20	25-Year Average	$19.34	

Florida CONTINUED

General Assumptions	Florida-Specific Assumptions
Electricity Rates • 2.5% annual electricity price escalation **PV System** • 4 kW • 0.5% annual degradation rate **Loan and Lease Terms** • Loan: 15 years; no payments in years 16–25 • Lease: 25 years **Federal Incentive** • Federal ITC (26%) **Other** • 0% discount rate	**Location and Utility** • Miami • Florida Power & Light **PV System Cost** • $3.27 per watt **State Incentives** • Property Tax Exemption • Sales Tax Exemption **Rate Tariff** • RS-1 Residential Service (Tiered rates) • Fixed charge: $8.34/month • Tiered rates w/ adders ranging from 8.57 cents/kWh to 10.63 cents/kWh

Georgia

Typical Electric Bill and Solar Installation Impact

	Monthly Electric Bill without Solar	Monthly Electric Bill with Solar	Monthly Electric Bill Savings
Year One	$113.58	$64.92	$48.66
25-Year Average	$155.19	$92.65	$62.54

Financing Scenarios

Scenario	Monthly Loan Payment (first 15 years) or Lease Payment	Net Monthly Savings		Payback Period
Market Rate Loan (4.74%) without Special State Incentives				
Loan for homeowner who qualities for federal tax credit	$100.21	Year One	($54.93)	22 Years
		25-Year Average	$11.74	
Loan with federal tax credit received and excluded from upfront cost	$74.13	Year One	($28.85)	21 Years
		25-Year Average	$16.38	
Loan with no federal or state tax credit	$100.21	Year One	($54.93)	25 Years
		25-Year Average	$0.73	
State Incentive: 2% Interest Rate				
Loan for homeowner who qualities for federal tax credit	$82.39	Year One	($37.11)	19 Years
		25-Year Average	$22.43	
Loan with federal tax credit received and excluded from upfront cost	$60.95	Year One	($15.67)	18 Years
		25-Year Average	$24.29	
Loan with no federal or state tax credit	$82.39	Year One	($37.11)	22 Years
		25-Year Average	$11.42	
State Incentive: $5,000 Rebate				
Loan for homeowner who qualities for federal tax credit	$60.77	Year One	($15.49)	15 Years
		25-Year Average	$35.40	
Loan with federal tax credit received and excluded from upfront cost	$34.69	Year One	$10.59	13 Years
		25-Year Average	$40.04	
Loan with no federal or state tax credit	$60.77	Year One	($15.49)	18 Years
		25-Year Average	$24.39	
Lease				
Lease (15% first year savings with 2.5% escalator)	Year One: $36.26	Year One	$18.65	N/A
	25-Year Average: $49.54	25-Year Average	$20.95	

Georgia CONTINUED

General Assumptions	Georgia-Specific Assumptions
Electricity Rates • 2.5% annual electricity price escalation **PV System** • 4 kW • 0.5% annual degradation rate **Loan and Lease Terms** • Loan: 15 years; no payments in years 16–25 • Lease: 25 years **Federal Incentive** • Federal ITC (26%) **Other** • 0% discount rate	**Location and Utility** • Atlanta • Georgia Power **PV System Cost** • $2.94 per watt for a 4-kW system • Assumes 0.5% annual degradation rate • Assumes 8.9% sales tax rate and 0.91% property tax rate **Rate Tariff** • R-23 Residential Service (Tiered rates with seasonal variation, includes several riders) • Fixed charge: $0.327869 per day; tiered rates range from 7.79 cents/kWh to 14.95 cents/kWh • Net Metering: Monthly netting with excess generation paid monthly at solar avoided cost rate

Kentucky

Typical Electric Bill and Solar Installation Impact

	Monthly Electric Bill without Solar	Monthly Electric Bill with Solar	Monthly Electric Bill Savings
Year One	$111.25	$69.75	$41.50
25-Year Average	$151.99	$98.95	$53.04

Financing Scenarios

Scenario	Monthly Loan Payment (first 15 years) or Lease Payment	Net Monthly Savings		Payback Period
Market Rate Loan (4.74%) without Special State Incentives				
Loan for homeowner who qualities for federal tax credit	$108.02	Year One	($77.36)	>25 Years
		25-Year Average	($10.74)	
Loan with federal tax credit received and excluded from upfront cost	$79.71	Year One	($49.05)	>25 Years
		25-Year Average	($5.63)	
Loan with no federal or state tax credit	$108.02	Year One	($77.36)	>25 Years
		25-Year Average	($22.61)	
State Incentive: 2% Interest Rate				
Loan for homeowner who qualities for federal tax credit	$88.81	Year One	($58.15)	25 Years
		25-Year Average	$0.78	
Loan with federal tax credit received and excluded from upfront cost	$65.54	Year One	($34.88)	24 Years
		25-Year Average	$2.87	
Loan with no federal or state tax credit	$88.81	Year One	($58.15)	>25 Years
		25-Year Average	($11.09)	
State Incentive: $5,000 Rebate				
Loan for homeowner who qualities for federal tax credit	$68.58	Year One	($37.92)	20 Years
		25-Year Average	$12.92	
Loan with federal tax credit received and excluded from upfront cost	$44.83	Year One	($9.61)	18 Years
		25-Year Average	$18.03	
Loan with no federal or state tax credit	$68.58	Year One	($37.92)	25 Years
		25-Year Average	$1.05	

Kentucky CONTINUED

General Assumptions	Kentucky-Specific Assumptions
Electricity Rates • 2.5% annual electricity price escalation **PV System** • 4 kW • 0.5% annual degradation rate **Loan Term** • Loan: 15 years; no payments in years 16–25 **Federal Incentive** • Federal ITC (26%) **Other** • 0% discount rate	**Location and Utility** • Louisville • Louisville Gas & Electric **PV System Cost** • $3.32 per watt **Rate Tariff** • RS Residential Service: Fixed charge of $0.45/day; 9.278 cents/kWh **Taxes** • Property tax rate of 0.95% • Sales tax rate of 6% **Other** • No lease option, because third-party ownership of residential systems not permitted

Maine

Typical Electric Bill and Solar Installation Impact

	Monthly Electric Bill without Solar	Monthly Electric Bill with Solar	Monthly Electric Bill Savings
Year One	$63.17	$31.58	$31.59
25-Year Average	$86.33	$45.85	$40.48

Financing Scenarios

Scenario	Monthly Loan Payment (first 15 years) or Lease Payment	Net Monthly Savings		Payback Period
Market Rate Loan (4.74%) without Special State Incentives				
Loan for homeowner who qualities for federal tax credit	$97.36	Year One	($65.77)	>25 Years
		25-Year Average	($7.24)	
Loan with federal tax credit received and excluded from upfront cost	$72.05	Year One	($40.46)	>25 Years
		25-Year Average	($2.75)	
Loan with no federal or state tax credit	$97.36	Year One	($65.77)	>25 Years
		25-Year Average	($17.94)	
State Incentive: 2% Interest Rate				
Loan for homeowner who qualities for federal tax credit	$80.05	Year One	($48.46)	24 Years
		25-Year Average	$3.15	
Loan with federal tax credit received and excluded from upfront cost	$59.24	Year One	($27.65)	23 Years
		25-Year Average	$4.94	
Loan with no federal or state tax credit	$80.05	Year One	($48.46)	>25 Years
		25-Year Average	$7.55	
State Incentive: $5,000 Rebate				
Loan for homeowner who qualities for federal tax credit	$57.92	Year One	($26.33)	17 Years
		25-Year Average	$16.42	
Loan with federal tax credit received and excluded from upfront cost	$31.59	Year One	($1.02)	16 Years
		25-Year Average	$20.91	
Loan with no federal or state tax credit	$57.92	Year One	($26.33)	23 Years
		25-Year Average	$5.73	
Lease				
Lease (15% first year savings with 2.5% escalator)	Year One: $22.01	Year One	$9.48	N/A
	25-Year Average: $30.07	25-Year Average	$10.41	

Maine CONTINUED

General Assumptions	Maine-Specific Assumptions
Electricity Rates • 2.5% annual electricity price escalation **PV System** • 4 kW • 0.5% annual degradation rate **Loan and Lease Terms** • Loan: 15 years; no payments in years 16–25 • Lease: 25 years **Federal Incentive** • Federal ITC (26%) **Other** • 0% discount rate	**Location and Utility** • Portland Central Maine Power **PV System Cost** • $3.00 per watt **State Incentives** • Property Tax Exemption **Rate Tariff** • Standard residential tariff • First 50 kWh or less: $12.76/month • All additional kWh: 7.19 cents/kWh **Taxes** • 5.5% sales tax rate

Michigan

Typical Electric Bill and Solar Installation Impact

	Monthly Electric Bill without Solar	Monthly Electric Bill with Solar	Monthly Electric Bill Savings
Year One	$120.67	$70.08	$50.59
25-Year Average	$164.89	$99.01	$65.88

Financing Scenarios

Scenario	Monthly Loan Payment (first 15 years) or Lease Payment	Net Monthly Savings		Payback Period
Market Rate Loan (4.74%) without Special State Incentives				
Loan for homeowner who qualities for federal tax credit	$124.94	Year One	($74.35)	24 Years
		25-Year Average	$4.64	
Loan with federal tax credit received and excluded from upfront cost	$92.40	Year One	($41.81)	22 Years
		25-Year Average	$10.44	
Loan with no federal or state tax credit	$124.94	Year One	($74.35)	>25 Years
		25-Year Average	$9.08	
State Incentive: 2% Interest Rate				
Loan for homeowner who qualities for federal tax credit	$102.73	Year One	($52.14)	20 Years
		25-Year Average	$17.97	
Loan with federal tax credit received and excluded from upfront cost	$75.97	Year One	($25.38)	19 Years
		25-Year Average	$20.30	
Loan with no federal or state tax credit	$102.73	Year One	($52.14)	24 Years
		25-Year Average	$4.24	
State Incentive: $5,000 Rebate				
Loan for homeowner who qualities for federal tax credit	$85.50	Year One	($34.91)	16 Years
		25-Year Average	$28.31	
Loan with federal tax credit received and excluded from upfront cost	$52.96	Year One	($2.37)	14 Years
		25-Year Average	$34.10	
Loan with no federal or state tax credit	$85.50	Year One	($34.91)	21 Years
		25-Year Average	$14.58	
Lease				
Lease (15% first year savings with 2.5% escalator)	Year One: $32.49	Year One	$18.10	N/A
	25-Year Average: $44.39	25-Year Average	$21.49	

Michigan CONTINUED

General Assumptions	Michigan-Specific Assumptions
Electricity Rates • 2.5% annual electricity price escalation **PV System** • 4 kW • 0.5% annual degradation rate **Loan and Lease Terms** • Loan: 15 years; no payments in years 16–25 • Lease: 25 years **Federal Incentive** • Federal ITC (26%) **Other** • 0% discount rate	**Location and Utility** • Detroit • DTE Electric **PV System Cost** • $3.84 per watt **State Incentives** • Property Tax Exemption **Rate Tariff** • D-1 Residential Service • Fixed charge: $7.50/month • Energy Rates: 14.501 cents/kWh (up to 17 kWh per day); 16.135 cents/kWh (over 17 kWh per day) • Outflow Rates: 7.477 cents/kWh (up to 17 kWh per day); 9.111 cents/kWh (over 17 kWh per day) **Taxes** • Sales tax rate of 6%

Missouri

Typical Electric Bill and Solar Installation Impact

	Monthly Electric Bill without Solar	Monthly Electric Bill with Solar	Monthly Electric Bill Savings
Year One	$132.50	$83.92	$48.58
25-Year Average	$181.02	$119.22	$61.80

Financing Scenarios

Scenario	Monthly Loan Payment (first 15 years) or Lease Payment	Net Monthly Savings		Payback Period
Market Rate Loan (4.74%) without Special State Incentives				
Loan for homeowner who qualities for federal tax credit	$92.66	Year One	($44.08)	20 Years
		25-Year Average	$17.25	
Loan with federal tax credit received and excluded from upfront cost	$66.61	Year One	($18.03)	18 Years
		25-Year Average	$21.83	
Loan with no federal or state tax credit	$100.54	Year One	($44.08)	25 Years
		25-Year Average	$6.21	
State Incentive: 2% Interest Rate				
Loan for homeowner who qualities for federal tax credit	$76.18	Year One	($27.60)	16 Years
		25-Year Average	$27.14	
Loan with federal tax credit received and excluded from upfront cost	$54.77	Year One	($6.19)	15 Years
		25-Year Average	$28.94	
Loan with no federal or state tax credit	$82.67	Year One	($27.60)	21 Years
		25-Year Average	$16.09	
State Incentive: $5,000 Rebate				
Loan for homeowner who qualities for federal tax credit	$53.21	Year One	($4.63)	10 Years
		25-Year Average	$40.92	
Loan with federal tax credit received and excluded from upfront cost	$27.17	Year One	$17.45	8 Years
		25-Year Average	$43.12	
Loan with no federal or state tax credit	$53.21	Year One	($4.63)	15 Years
		25-Year Average	$29.87	

Missouri CONTINUED

General Assumptions	Missouri-Specific Assumptions
Electricity Rates • 2.5% annual electricity price escalation **PV System** • 4 kW • 0.5% annual degradation rate **Loan Term** • Loan: 15 years; no payments in years 16-25 **Federal Incentive** • Federal ITC (26%) **Other** • 0% discount rate	**Location and Utility** • Kansas City • Evergy **PV System Cost** • $3.05 per watt **State Incentives** • $0.25/W Rebate (for scenarios with a $5,000 rebate, the $0.25/W rebate is included as part of the larger rebate) • Property Tax Exemption **Rate Tariff** • Schedule R - Residential Service • Fixed charge: $11.47/month • Tiered and seasonal energy rates - summer rates range from 13.511 cents/kWh to 14.916 cents/kWh, winter rates range from 6.561 cents/kWh to 12.013 cents/kWh **Taxes** • Sales tax rate of 8.61% **Other** • No lease option, because third-party ownership of residential systems not permitted

New Mexico

Typical Electric Bill and Solar Installation Impact

	Monthly Electric Bill without Solar	Monthly Electric Bill with Solar	Monthly Electric Bill Savings
Year One	$75.58	$18.58	$57.00
25-Year Average	$103.28	$29.45	$73.82

Financing Scenarios

Scenario	Monthly Loan Payment (first 15 years) or Lease Payment	Net Monthly Savings		Payback Period
Market Rate Loan (4.74%) without Special State Incentives				
Loan for homeowner who qualities for federal tax credit	$123.69	Year One	($65.20)	20 Years
		25-Year Average	$19.99	
Loan with federal tax credit received and excluded from upfront cost	$79.20	Year One	($20.71)	18 Years
		25-Year Average	$26.77	
Loan with no federal or state tax credit	$123.69	Year One	($65.20)	25 Years
		25-Year Average	$0.08	
State Incentive: 2% Interest Rate				
Loan for homeowner who qualities for federal tax credit	$101.69	Year One	($43.20)	16 Years
		25-Year Average	$32.09	
Loan with federal tax credit received and excluded from upfront cost	$65.11	Year One	($6.62)	15 Years
		25-Year Average	$35.22	
Loan with no federal or state tax credit	$101.69	Year One	($43.20)	22 Years
		25-Year Average	$13.27	
State Incentive: $5,000 Rebate				
Loan for homeowner who qualities for federal tax credit	$84.24	Year One	($25.75)	13 Years
		25-Year Average	$42.56	
Loan with federal tax credit received and excluded from upfront cost	$39.76	Year One	$18.73	10 Years
		25-Year Average	$50.43	
Loan with no federal or state tax credit	$84.24	Year One	($25.75)	19 Years
		25-Year Average	$23.74	
Lease				
Lease (15% first year savings with 2.5% escalator)	Year One: $45.66	Year One	$11.34	N/A
	25-Year Average: $62.39	25-Year Average	$11.43	

New Mexico CONTINUED

General Assumptions	New Mexico-Specific Assumptions
Electricity Rates • 2.5% annual electricity price escalation **PV System** • 4 kW • 0.5% annual degradation rate **Loan and Lease Terms** • Loan: 15 years; no payments in years 16–25 • Lease: 25 years **Federal Incentive** • Federal ITC (26%) **Other** • 0% discount rate	**Location and Utility** • Albuquerque • PNM **PV System Cost** • $3.92 per watt **State Incentives** • Property Tax Exemption • Sales Tax Exemption • PNM REC Purchase Program ($0.0025/kWh for 8 years) **Rate Tariff** • 1-A Residential Service (Tiered rates with seasonal variation) • Fixed charge: $7.11/month • Tiered rates range from 7.79 cents/kWh to 14.95 cents/kWh

North Carolina

Typical Electric Bill and Solar Installation Impact

	Monthly Electric Bill without Solar	Monthly Electric Bill with Solar	Monthly Electric Bill Savings
Year One	$111.75	$67.75	$44.00
25-Year Average	$152.68	$96.45	$56.23

Financing Scenarios

Scenario	Monthly Loan Payment (first 15 years) or Lease Payment	Net Monthly Savings		Payback Period
Market Rate Loan (4.74%) without Special State Incentives				
Loan for homeowner who qualities for federal tax credit	$83.88	Year One	($39.88)	19 Years
		25-Year Average	$17.20	
Loan with federal tax credit received and excluded from upfront cost	$57.03	Year One	($13.03)	17 Years
		25-Year Average	$22.01	
Loan with no federal or state tax credit	$102.81	Year One	($39.88)	>25 Years
		25-Year Average	$5.90	
State Incentive: 2% Interest Rate				
Loan for homeowner who qualities for federal tax credit	$68.96	Year One	($24.96)	15 Years
		25-Year Average	$26.15	
Loan with federal tax credit received and excluded from upfront cost	$46.89	Year One	($2.89)	15 Years
		25-Year Average	$28.10	
Loan with no federal or state tax credit	$84.53	Year One	($24.96)	24 Years
		25-Year Average	$14.85	
State Incentive: $5,000 Rebate				
Loan for homeowner who qualities for federal tax credit	$44.44	Year One	($0.44)	9 Years
		25-Year Average	$40.86	
Loan with federal tax credit received and excluded from upfront cost	$17.59	Year One	$26.41	6 Years
		25-Year Average	$45.68	
Loan with no federal or state tax credit	$44.44	Year One	($0.44)	14 Years
		25-Year Average	$29.57	
Lease				
Lease (15% first year savings with 2.5% escalator)	Year One: $27.24	Year One	$16.76	N/A
	25-Year Average: $37.22	25-Year Average	$19.01	

North Carolina CONTINUED

General Assumptions	North Carolina-Specific Assumptions
Electricity Rates • 2.5% annual electricity price escalation **PV System** • 4 kW • 0.5% annual degradation rate **Loan and Lease Terms** • Loan: 15 years; no payments in years 16-25 • Lease: 25 years **Federal Incentive** • Federal ITC (26%) **Other** • 0% discount rate	**Location and Utility** • Charlotte • Duke Energy Carolinas **PV System Cost** • $3.14 per watt **State Incentives** • Duke Energy Rebate ($0.60/W); (for scenarios with a $5,000 rebate, the $0.60/W rebate is included as part of the larger rebate) • Property Tax Exemption **Rate Tariff** • RS Residential Service • Fixed Charge: $14.00/month • Energy Rates: Flat rate with several riders (9.24 cents/kWh) **Taxes** • Sales tax rate of 7.25% **Other** • According to H.B. 589 of 2017, investor-owned utilities are to file revised net metering rates and current customers will be grand-fathered until July 2027. These rates have not yet been filed.

Ohio

Typical Electric Bill and Solar Installation Impact

	Monthly Electric Bill without Solar	Monthly Electric Bill with Solar	Monthly Electric Bill Savings
Year One	$96.58	$50.08	$46.50
25-Year Average	$131.99	$72.44	$59.55

Financing Scenarios

Scenario	Monthly Loan Payment (first 15 years) or Lease Payment	Net Monthly Savings		Payback Period
Market Rate Loan (4.74%) without Special State Incentives				
Loan for homeowner who qualities for federal tax credit	$111.18	Year One	($64.68)	24 Years
		25-Year Average	$5.06	
Loan with federal tax credit received and excluded from upfront cost	$82.41	Year One	($35.91)	22 Years
		25-Year Average	$10.11	
Loan with no federal or state tax credit	$111.18	Year One	($64.68)	>25 Years
		25-Year Average	($7.16)	
State Incentive: 2% Interest Rate				
Loan for homeowner who qualities for federal tax credit	$91.41	Year One	($44.91)	20 Years
		25-Year Average	$16.92	
Loan with federal tax credit received and excluded from upfront cost	$67.75	Year One	($21.15)	19 Years
		25-Year Average	$18.90	
Loan with no federal or state tax credit	$91.41	Year One	($44.91)	24 Years
		25-Year Average	$4.70	
State Incentive: $5,000 Rebate				
Loan for homeowner who qualities for federal tax credit	$71.74	Year One	($25.24)	15 Years
		25-Year Average	$28.72	
Loan with federal tax credit received and excluded from upfront cost	$42.97	Year One	$3.53	13 Years
		25-Year Average	$33.77	
Loan with no federal or state tax credit	$71.74	Year One	($25.24)	20 Years
		25-Year Average	$16.50	
Lease				
Lease (15% first year savings with 2.5% escalator)	Year One: $32.01	Year One	$14.49	N/A
	25-Year Average: $43.74	25-Year Average	$15.81	

Ohio CONTINUED

General Assumptions	Ohio-Specific Assumptions
Electricity Rates • 2.5% annual electricity price escalation **PV System** • 4 kW • 0.5% annual degradation rate **Loan and Lease Terms** • Loan: 15 years; no payments in years 16–25 • Lease: 25 years **Federal Incentive** • Federal ITC (26%) **Other** • 0% discount rate	**Location and Utility** • Columbus • AEP Ohio **PV System Cost** • $3.40 per watt **State Incentives** • Property Tax Exemption **Rate Tariff** • Schedule RS Residential Service • Fixed Charge: $8.40/month • Energy Rate (Average Ohio Residential Rate): 11.78 cents/kWh • NEG credited at unbundled generation rate (3.72 cents/kWh) **Taxes** • 7% sales tax rate

South Carolina

Typical Electric Bill and Solar Installation Impact

	Monthly Electric Bill without Solar	Monthly Bill with Solar, 4-kW System	Monthly Bill with Solar, 6.44-kW System	Monthly Electric Bill Savings, 4kW System	Monthly Electric Bill Savings, 6.4kW System
Year One	$153.42	$96.67	$63.25	$56.75	$90.17
25-Year Average	$209.60	$136.90	$94.19	$72.70	$115.41

Financing Scenarios (4 Kilowatt System)

Scenario	Monthly Loan Payment (first 15 years) or Lease Payment	Net Monthly Savings		Payback Period
Market Rate Loan (4.74%) without Special State Incentives				
Loan for homeowner who qualities for federal tax credit	$106.60	Year One	($55.26)	18 Years
		25-Year Average	$26.311	
Loan with federal tax credit received and excluded from upfront cost	$52.32	Year One	($0.98)	15 Years
		25-Year Average	$35.90	
Loan with no federal or state tax credit	$106.60	Year One	($55.26)	25 Years
		25-Year Average	$3.33	
State Incentive: 2% Interest Rate				
Loan for homeowner who qualities for federal tax credit	$87.65	Year One	($36.31)	14 Years
		25-Year Average	$37.68	
Loan with federal tax credit received and excluded from upfront cost	$43.02	Year One	$8.32	13 Years
		25-Year Average	$41.48	
Loan with no federal or state tax credit	$87.65	Year One	($36.31)	24 Years
		25-Year Average	$14.71	
State Incentive: $5,000 Rebate				
Loan for homeowner who qualities for federal tax credit	$67.16	Year One	10 Years	10 Years
		25-Year Average		
Loan with federal tax credit received and excluded from upfront cost	$12.88	Year One	6 Years	6 Years
		25-Year Average		
Loan with no federal or state tax credit	$67.16	Year One	18 Years	18 Years
		25-Year Average		
Lease				
Lease (15% first year savings with 2.5% escalator)	Year One: $33.74	Year One	$23.01	N/A
	25-Year Average: $46.10	25-Year Average	$26.60	

South Carolina CONTINUED

Financing Scenarios (6.4 Kilowatt System)

Scenario	Monthly Loan Payment (first 15 years) or Lease Payment	Net Monthly Savings		Payback Period
Market Rate Loan (4.74%) without Special State Incentives				
Loan for homeowner who qualities for federal tax credit	$165.86	Year One	($84.10)	19 Years
		25-Year Average	$37.37	
Loan with federal tax credit received and excluded from upfront cost	$95.22	Year One	($13.46)	16 Years
		25-Year Average	$49.86	
Loan with no federal or state tax credit	$165.86	Year One	($84.10)	24 Years
		25-Year Average	$7.48	
State Incentive: 2% Interest Rate				
Loan for homeowner who qualities for federal tax credit	$136.37	Year One	($54.61)	15 Years
		25-Year Average	$55.07	
Loan with federal tax credit received and excluded from upfront cost	$78.29	Year One	$3.47	14 Years
		25-Year Average	$60.02	
Loan with no federal or state tax credit	$136.37	Year One	($54.61)	21 Years
		25-Year Average	$25.18	
State Incentive: $5,000 Rebate				
Loan for homeowner who qualities for federal tax credit	$126.42	Year One	($44.66)	14 Years
		25-Year Average	$61.04	
Loan with federal tax credit received and excluded from upfront cost	$55.78	Year One	$25.98	11 Years
		25-Year Average	$73.53	
Loan with no federal or state tax credit	$126.42	Year One	($44.66)	20 Years
		25-Year Average	$31.15	
Lease				
Lease (15% first year savings with 2.5% escalator)	Year One: $67.16	Year One	$23.01	N/A
	25-Year Average: $91.76	25-Year Average	$23.65	

South Carolina CONTINUED

General Assumptions	South Carolina-Specific Assumptions
Electricity Rates • 2.5% annual electricity price escalation **PV System** • 4 kW and 6.4 kW • 0.5% annual degradation rate **Loan and Lease Terms** • Loan: 15 years; no payments in years 16-25 • Lease: 25 years **Federal Incentive** • Federal ITC (26%) **Other** • 0% discount rate	**Location and Utility** • Charleston • Dominion Energy **PV System Cost** • $3.26 per watt for a 4-kW system • $3.17 per watt for a 6.4-kW system **State Incentives** • State Tax Credit (25%, up to $3,500) **Rate Tariff** • Rate 8 – Residential Service • Fixed charge: $9.00/month • Tiered and seasonal energy rates – summer rates range from 11.602 cents/kWh to 12.788 cents/kWh, winter rates range from 11.13 cents/kWh to 11.602 cents/kWh **Taxes** • Sales tax rate of 7% • Property tax rate of 0.48% **Other** • According to H.B. 3659 of 2019, a net metering successor tariff will take effect in June 2021. Existing customers will be grandfathered until May 31, 2029

Texas

Typical Electric Bill and Solar Installation Impact

	Monthly Electric Bill without Solar	Monthly Electric Bill with Solar	Monthly Electric Bill Savings
Year One	$142.00	$94.17	$47.83
25-Year Average	$193.99	$132.86	$61.13

Financing Scenarios

Scenario	Monthly Loan Payment (first 15 years) or Lease Payment	Net Monthly Savings		Payback Period
Market Rate Loan (4.74%) without Special State Incentives				
Loan for homeowner who qualities for federal tax credit	$103.58	Year One	($55.75)	22 Years
		25-Year Average	$10.36	
Loan with federal tax credit received and excluded from upfront cost	$76.53	Year One	(28.70)	20Years
		25-Year Average	$15.21	
Loan with no federal or state tax credit	$103.58	Year One	($55.75)	>25 Years
		25-Year Average	($1.02)	
State Incentive: 2% Interest Rate				
Loan for homeowner who qualities for federal tax credit	$85.16	Year One	($37.33)	18 Years
		25-Year Average	$21.41	
Loan with federal tax credit received and excluded from upfront cost	$62.92	Year One	($15.09)	17 Years
		25-Year Average	$23.38	
Loan with no federal or state tax credit	$85.16	Year One	($37.33)	22 Years
		25-Year Average	$10.03	
State Incentive: $5,000 Rebate				
Loan for homeowner who qualities for federal tax credit	$64.14	Year One	($16.31)	13 Years
		25-Year Average	$34.03	
Loan with federal tax credit received and excluded from upfront cost	$41.38	Year One	$10.74	11 Years
		25-Year Average	$38.88	
Loan with no federal or state tax credit	$37.09	Year One	($16.31)	18 Years
		25-Year Average	$22.65	
Lease				
Lease (15% first year savings with 2.5% escalator)	Year One: $26.53	Year One	$21.30	N/A
	25-Year Average: $36.25	25-Year Average	$24.88	

Texas CONTINUED

General Assumptions	Texas-Specific Assumptions
Electricity Rates • 2.5% annual electricity price escalation **PV System** • 4 kW • 0.5% annual degradation rate **Loan and Lease Terms** • Loan: 15 years; no payments in years 16–25 • Lease: 25 years **Federal Incentive** • Federal ITC (26%) **Other** • 0% discount rate	**Location and Utility** • Houston • CenterPoint Energy and Green Mountain Energy **PV System Cost** • $3.14 per watt **State Incentives** • Property Tax Exemption **Rate Tariff** • Green Mountain Energy Renewable Rewards Program and Pollution Free e-Plus 24 Plan (Base Energy Charge: $0, Energy Charge: 7.2199 cents/kWh, CenterPoint Energy Delivery Charges: $4.39/mo and 3.7105 cents/kWh) **Taxes** • 8.75% sales tax rate

Virginia

Typical Electric Bill and Solar Installation Impact

	Monthly Electric Bill without Solar	Monthly Bill with Solar, 4-kW System	Monthly Bill with Solar, 6.44-kW System	Monthly Electric Bill Savings, 4kW System	Monthly Electric Bill Savings, 6.4kW System
Year One	$122.25	$70.42	$38.50	$51.83	$83.75
25-Year Average	$167.07	$100.81	$60.06	$66.26	$107.01

Financing Scenarios (4 Kilowatt System)

Scenario	Monthly Loan Payment (first 15 years) or Lease Payment	Net Monthly Savings		Payback Period
Market Rate Loan (4.74%) without Special State Incentives				
Loan for homeowner who qualities for federal tax credit	$107.37	Year One	($65.41)	24 Years
		25-Year Average	$0.06	
Loan with federal tax credit received and excluded from upfront cost	$78.74	Year One	($36.78)	23 Years
		25-Year Average	$9.15	
Loan with no federal or state tax credit	$107.37	Year One	($65.41)	>25 Years
		25-Year Average	($8.03)	
State Incentive: 2% Interest Rate				
Loan for homeowner who qualities for federal tax credit	$88.28	Year One	($46.32)	21 Years
		25-Year Average	$15.22	
Loan with federal tax credit received and excluded from upfront cost	$64.74	Year One	($22.78)	20 Years
		25-Year Average	$17.55	
Loan with no federal or state tax credit	$88.28	Year One	($46.32)	24 Years
		25-Year Average	$3.42	
State Incentive: $5,000 Rebate				
Loan for homeowner who qualities for federal tax credit	$67.93	Year One	($25.97)	17 Years
		25-Year Average	$27.43	
Loan with federal tax credit received and excluded from upfront cost	$39.30	Year One	$2.66	15 Years
		25-Year Average	$32.81	
Loan with no federal or state tax credit	$67.93	Year One	($25.97)	21 Years
		25-Year Average	$15.63	

Virginia CONTINUED

Financing Scenarios (6.4 Kilowatt System)

Scenario	Monthly Loan Payment (first 15 years) or Lease Payment	Net Monthly Savings		Payback Period
Market Rate Loan (4.74%) without Special State Incentives				
Loan for homeowner who qualities for federal tax credit	$158.78	Year One	($89.62)	23 Years
		25-Year Average	$14.60	
Loan with federal tax credit received and excluded from upfront cost	$116.09	Year One	($59.22)	21 Years
		25-Year Average	$22.76	
Loan with no federal or state tax credit	$158.78	Year One	($89.62)	>25 Years
		25-Year Average	($2.85)	
State Incentive: 2% Interest Rate				
Loan for homeowner who qualities for federal tax credit	$130.55	Year One	($61.39)	19
		25-Year Average	$31.54	
Loan with federal tax credit received and excluded from upfront cost	$95.45	Year One	($36.47)	19 Years
		25-Year Average	$35.15	
Loan with no federal or state tax credit	$130.55	Year One	($61.39)	23 Years
		25-Year Average	$14.09	
State Incentive: $5,000 Rebate				
Loan for homeowner who qualities for federal tax credit	$119.34	Year One	($50.18)	18 Years
		25-Year Average	$38.26	
Loan with federal tax credit received and excluded from upfront cost	$76.65	Year One	($7.49)	16 Years
		25-Year Average	$46.43	
Loan with no federal or state tax credit	$119.34	Year One	($50.18)	22 Years
		25-Year Average	$20.81	

Virginia CONTINUED

General Assumptions	Virginia-Specific Assumptions
Electricity Rates • 2.5% annual electricity price escalation **PV System** • 4 kW and 6.4 kW • 0.5% annual degradation rate **Loan and Lease Terms** • Loan: 15 years; no payments in years 16–25 • Lease: 25 years **Federal Incentive** • Federal ITC (26%) **Other** • 0% discount rate	**Location and Utility** • Virginia Beach • Dominion Energy **PV System Cost** • $3.30 per watt for a 4-kW system • $3.05 per watt for a 6.4-kW system **Rate Tariff** • Schedule 1 – Residential Service • Fixed Charge: $6.58/month • Energy Rates: Tiered and seasonal rates with several riders. Rates range from 9.44 cents/kWh to 12.13 cents/kWh **Taxes** Sales tax rate of 6% Property tax rate of 0.87% **Other** • No lease option, because third-party ownership of residential systems not permitted

HOW THE NUMBERS WERE CALCULATED

Autumn Proudlove and Brian Lips used the National Renewable Energy Laboratory's System Advisor Model (SAM) to assess the economics of a 4-kW solar PV system with a 25-year life installed in 14 different states. They assumed that the system was installed in the largest city served by an investor-owned utility in each state. Several pieces of data were gathered for each assessment and entered into SAM for the analysis (see Table APP-A1).

The cost for a 4-kW system in each state was provided to the team by EnergySage. The prices ranged from $2.94 to $3.92 per watt, with an average cost of $3.32 per watt. The team then referenced the Database of State Incentives for Renewables and Efficiency (DSIRE) and DSIRE Insight to collect details on all available incentives in each state, as well as each utility's net metering or net billing rules. For states without a property or sales tax exemption, the team applied the average property tax rate and the sales tax rate for the city analyzed. A federal investment tax credit of 26 percent was used in those scenarios that included tax credits.

The team referenced each utility's website for the specific terms of its net metering or net billing tariff, as well as its default residential electric rates or required rates for customer-generators. In some cases, the team had to add numerous riders to the electricity rates to determine the full cost of electricity. In Houston, Texas for example, where customers have retail electric choice, the team selected Green Mountain Energy as the retail electricity supplier, as it offers a net metering program.

For simplicity, the team did not apply a discount rate and did not include any ongoing insurance or operation and maintenance expenses. The team did, however, apply a 2.5 percent electricity cost escalation rate and a 0.5 percent annual AC degradation rate, which reflects a reduction in the system's annual energy output. Residential hourly load profiles for each city were downloaded from OpenEI and imported into SAM. The team assumed a 0 percent annual load growth rate.

Based on the electricity rates, net metering parameters, and load profiles provided, SAM calculates the average monthly electric bill for the consumer with and without solar. These monthly bill savings were then compared to the monthly loan payments a system owner would have to make based on a 15-year loan at 4.74 percent and 2 percent interest rates to show the net savings or cost for a customer financing a PV system. To calculate the system's payback period, the team calculated the total system cost (the sum of the loan payments and property taxes over 25 years, minus any incentives) and identified the year in which cumulative electric bill savings would surpass the total system cost.

The team analyzed scenarios where the federal investment tax credit and any applicable state tax credits are claimed at the end of year one (and therefore included in the total loan amount), as well as scenarios which omit the tax credits from the loan amount. Scenarios for both the 4.74 percent and 2 percent interest rate loans where no tax credits are available were also analyzed. Additionally, the team analyzed scenarios in which each state offers a hypothetical $5,000 upfront rebate.

The team also used SAM to calculate the economics of a solar lease in states where leasing is permitted. EnergySage provided data on solar lease costs for Arizona, California, and Texas. For other states allowing leases, the team used the same lease parameters provided for Arizona and Texas. The lease data provided by EnergySage is structured as a percentage

discount in the first year. The team applied a 2.5 percent escalator to the payments and used a 25-year term. As solar lease cost data is typically not published publicly, these leasing scenarios are intended to be illustrative, but may not represent the solar leasing deals actually being offered in each state.

TABLE APP-A2: **Location of Modeled Systems with Rates and Incentives Applied**

State	City	Utility	Electricity Rate	State/Utility Incentives
Arizona	Phoenix	Arizona Public Service	R-TOU-E	State Tax Credit Property Tax Exemption Sales Tax Exemption
California	Orange County	Southern California Edison	TOU-D-4-9PM	Property Tax Exemption Sales Tax Exemption
Florida	Miami	Florida Power & Light	RS-1	Property Tax Exemption Sales Tax Exemption
Georgia	Atlanta	Georgia Power	R-23	None
Kentucky	Louisville	Louisville Gas & Electric	RS	None
Maine	Portland	Central Maine Power	A	Property Tax Exemption
Michigan	Detroit	DTE Electric	D-1	Property Tax Exemption
Missouri	Kansas City	Evergy	R	Utility Rebate Property Tax Exemption
New Mexico	Albuquerque	PNM	1-A	State Tax Credit Utility REC Incentive Property Tax Exemption Sales Tax Exemption
North Carolina	Charlotte	Duke Energy Carolinas	RS	Utility Rebate Property Tax Exemption
Ohio	Columbus	AEP Ohio	RS	Property Tax Exemption
South Carolina	Charleston	Dominion Energy South Carolina	8	State Tax Credit
Texas	Houston	Centerpoint Energy/ Green Mountain Energy	Green Mountain Energy Pollution Free e-Plus 24 Plan	Property Tax Exemption
Virginia	Virginia Beach	Dominion Energy Virginia	1	None

APPENDIX B

Twelve Additional States

This appendix includes brief information about the manufactured homes housing stock and solar markets in 12 states that are not featured in the rest of the report.

When the project team started the research for the report, they started by looking at every state's total housing units and manufactured homes, as estimated in the US Census Bureau's 2017 American Community Survey (ACS). Twenty-six states were assessed as possible targets for detailed study. Those states either had a large absolute number of manufactured homes (at least 166,000) or a high percentage of the housing stock was manufactured homes (at least 9 percent).

The team ultimately narrowed the focus to 14 states, but in the meantime, they had collected some relevant information about the other 12 states. The fact that a state was not made a target for this report does not necessarily mean that it is a less promising market for solar for manufactured homes. In choosing the 14 states, a range of factors was considered, including geographic distribution across the country. In the case of New York, for example, it was excluded from this study because an initiative was already underway by the New York State Research and Development Authority (NYSERDA) to analyze the state's potential market for solar for manufactured homes.

In the months since research began for this report, the US Census Bureau's American Community Survey for 2019 has been issued, so those updated numbers are included in this appendix and elsewhere in the report.

TABLE APP-B1: **Manufactured Homes in 12 Non-Target States**[1]

	Housing Unit Estimate July 1, 2019	# of manufactured homes	% manufactured homes
Alabama	2,255,026	298,781	13%
Arkansas	1,370,281	165,147	12%
Idaho	723,594	59,125	8%
Louisiana	2,059,918	269,613	13%
Mississippi	1,322,808	199,746	15%
Montana	510,180	54,273	11%
New York	8,322,722	191,403	2%
Pennsylvania	5,693,314	221,895	4%
Tennessee	2,963,486	271,232	9%
Washington	3,106,528	193,778	6%
West Virginia	892,182	132,061	15%
Wyoming	276,846	36,819	13%

1 US Census Bureau, ACS 2019 Table 2502, *https://data.census.gov/cedsci/table?q=B25024&g=0100000US.04000.001&tid=ACSDT5Y2019.B25024&hidePreview=true4.*

Below we provide brief summaries for 12 additional states regarding the potential for solar for manufactured homes: Alabama, Arkansas, Idaho, Louisiana, Mississippi, Montana, New York, Pennsylvania, Tennessee, Washington, West Virginia, and Wyoming.

ALABAMA

Manufactured Homes in Alabama

- Alabama ranks high among states in manufactured homes
  - 8th among all states in number of manufactured homes
  - 6th among states in share of housing units that are manufactured homes (13 percent)
- Most of the state's manufactured houses are located on private property rather than in manufactured home communities.
  - Datacomp has identified only 816 manufactured home communities with 36,846 homesites, accounting for only 13 percent of the state's manufactured homes. Datacomp's database does not list a homesite count for 273 of the communities, so there may be a somewhat larger number of manufactured homes in communities, but it is nevertheless clear that the vast majority of manufactured homes in Alabama are not in manufactured home communities.[2]
  - This could make it more difficult to market a dedicated initiative for solar for manufactured homes than in a state where the homeowners can be easily targeted because they are concentrated into manufactured home communities. On the other hand, the homeowners with homes on individually owned lots are more likely to have sufficient land around their house for a ground-mounted system.
- Few of the communities (2.9 percent) have been identified by Datacomp as restricted to residents over 55 years old.

Potential Opportunities for Solar for Manufactured Homes

- The solar energy potential in Alabama is above average (19th among states).
- Interest in solar has been growing in Alabama in recent years and the number of installations has increased. The state does not currently have as favorable solar policies as found in many other states, but new policies could be implemented if interest continues to grow.
- The best opportunities for solar for manufactured homes will likely be at the many manufactured homes sited on individually owned lots where the homeowners have sufficient land for a ground-mounted system.
- Allowing third-party ownership of residential installations could make it easier to have a successful LMI solar initiative.

2 Correspondence from Lance Latham, Deputy Director, Alabama Manufactured Housing Association, June 2020, confirmed that most manufactured homes in the state are on individual lots in rural areas.

- There are a large number of rural electric cooperatives and municipal utilities in the state. With 22 of the former and 36 of the latter, Alabama ranks 8th for these types of utilities of the 26 states studied. It could be desirable to involve these utilities when designing any solar program for manufactured homes.

ARKANSAS

Manufactured Homes in Arkansas

- Arkansas ranks 9th among states in share of housing units that are manufactured homes (12 percent)
- Most of the state's manufactured houses are located on private property rather than in manufactured home communities.
  - Datacomp has identified only 267 manufactured home communities with 10,258 home sites, accounting for only 6 percent of the state's manufactured homes. This is the fewest number of communities and second lowest percentage for any of the 26 states for which this project received Datacomp data. Although Datacomp's database does not list a homesite count for some of these communities, and there may be a somewhat larger number of manufactured homes in communities, it is nevertheless clear that a the vast majority of the manufactured homes in Alabama are not located in manufactured home communities.
- Few manufactured home communities are large.
- Datacomp has identified only 29 communities with more than 100 home sites. That is the lowest number for any of the 26 states with Datacomp data for this report.
- It could be more difficult to market a dedicated initiative for solar for manufactured homes in Arkansas than in a state where the homeowners can be easily reached because they are concentrated into manufactured home communities. On the other hand, the homeowners with homes on individually owned lots are more likely to have sufficient land around their house for a ground-mounted system.
- Only five communities have been identified by Datacomp as restricted to residents over 55 years old. This is tied with Mississippi for the fewest senior communities among the 26 states studied.

Potential Opportunities for Solar for Manufactured Homes

- The solar energy potential in Arkansas is above average (16th among states).
- Legislation was enacted in 2019 to allow solar leasing.
- Low electricity costs make it more challenging than in many other states for solar to be cost effective for homeowners.
- The best opportunities for solar for manufactured homes will likely be at the many homes on individually owned lots where the homeowners also own the land where the house resides and have sufficient land for a ground-mounted system.

IDAHO

Manufactured Homes in Idaho

- As a relatively small state in terms of population, Idaho does not have a large number of manufactured homes.
- With 8 percent of its housing units being manufactured homes, Idaho is ranked 19th among states for the percentage of manufactured homes in its housing stock.
- The 347 communities captured in the Datacomp database, with 15,893 home sites, represent 27 percent of the manufactured homes in the state. Although Datacomp's database does not list a homesite count for some of these communities, so there may be a somewhat larger number of manufactured homes in communities, it is nevertheless clear that most, manufactured homes in Idaho are not in manufactured home communities.
- A relatively high percentage of communities in the Datacomp database are restricted to seniors aged 55+ (11 percent).

Potential Opportunities for Solar for Manufactured Homes

- Idaho has a surprisingly strong solar resource for a northern state. It has the 12th highest solar energy potential among states, but the solar resource is generally better in the southern half of the state than further north.
- Low electricity costs, few favorable solar policies, and a prohibition on third-party ownership for residential solar installations make Idaho a challenging setting for an LMI solar program for manufactured homes.
- Although there is no state net metering law, all three of the state's IOUs offer net metering programs that apply the full retail rate on the following month's bill for surplus energy produced.
- Because there is no dominant segment of the market, it is not obvious which would be the best segment to target with an LMI solar program for manufactured homes. More research would need to be done to understand the composition of the market.

LOUISIANA

Manufactured Homes in Louisiana

- Louisiana ranks high among states in manufactured homes
  - 10th among all states in number of manufactured homes
  - 7th among states in share of housing units that are manufactured homes (13 percent)
- Most of the state's manufactured houses are located on private property rather than in manufactured home communities.
  - Datacomp has identified only 599 manufactured home communities with 26,597 homesites, accounting for only 10 percent of the state's manufactured homes.

This is the third lowest percentage for any of the 26 states for which this project received Datacomp data. Although Datacomp's database does not list a homesite count for some of these communities, and there may be a somewhat larger number of manufactured homes in communities, it is nevertheless clear that the vast majority of manufactured homes in Louisiana are not located in manufactured home communities.

  - This could make it more difficult to market a dedicated initiative for solar for manufactured homes in Louisiana than in a state where the homeowners can be easily reached because they are concentrated into manufactured home communities. On the other hand, the homeowners with homes on individually owned lots are more likely to have sufficient land around their house for a ground-mounted system.
  - Datacomp has identified only six communities that are restricted to residents older than 55. This represents only 1 percent of the communities in the Datacomp database, which is the lowest of any of the 26 states.

Potential Opportunities for Solar for Manufactured Homes

- The solar energy potential in Louisiana is above average (17th among states).
- Interest in solar has been growing in Louisiana in recent years and the number of installations has increased. The status does not currently have as favorable solar policies as many other states, but new policies could be implemented if interest continues to grow.
- The best opportunities for solar for manufactured homes will likely be at the many homes on individually owned lots where the homeowners also have sufficient land for a ground-mounted system.
- Louisiana has the lowest electricity costs in the country, which is good for consumers' wallets but makes it challenging for solar to compete.
- The private sector company PosiGen began working in New Orleans post-Hurricane Katrina to bring solar energy and energy efficiency to LMI residents. The resulting installations and considerable publicity around PosiGen's work in Louisiana have created interest in and familiarity with LMI solar.

MISSISSIPPI

Manufactured Homes in Mississippi

- A high share of the housing units in the state are manufactured homes (15 percent). This is the third highest percentage among states.
- Most of the state's manufactured houses are located on private property rather than in manufactured home communities.
  - Datacomp has identified only 292 manufactured home communities with 9,730 homesites, accounting for only 5 percent of the state's manufactured homes. This is the lowest percentage for any of the 26 states studied. Although Datacomp's database does not list a homesite count for some of these communities, so there

may be a somewhat larger number of manufactured homes in communities, it is nevertheless clear that the vast majority of manufactured homes in Mississippi are not located in manufactured home communities.

  - This could make it more difficult to market a dedicated initiative for solar for manufactured homes than in a state where the homeowners can be easily reached because they are concentrated into manufactured home communities. On the other hand, the homeowners with homes on individually owned lots are more likely to have sufficient land around their house for a ground-mounted system.

- Only five communities have been identified by Datacomp as restricted to residents over 55 years old. This is tied with Arkansas for the fewest retirement communities among the 26 states studied.

Potential Opportunities for Solar for Manufactured Homes

- Mississippi has an above-average solar resource, ranking 13th among states in solar energy potential.
- Interest in solar has been growing in Mississippi in recent years and the number of installations has increased.
- Relatively low electricity costs make it challenging for solar to compete.
- The best opportunities for solar for manufactured homes will likely be at the many homes on individually owned lots where the homeowners also own the land and have sufficient space for a ground-mounted system.
- With 26 rural electric cooperatives and 23 municipal utilities, Mississippi has a significant number of these types of utilities. It could be desirable to include these utilities when designing any solar program for manufactured homes.

MONTANA

Manufactured Homes in Montana

- A significant share of the housing units in the state are manufactured homes (11 percent); this ranks Montana 11th among states. Because Montana does not have a large population, the total number of manufactured homes is relatively low (55,335).
- The 277 communities captured in the Datacomp database, with 13,159 home sites, represent 24 percent of the manufactured homes in the state. Although Datacomp's database does not list a homesite count for some of these communities, and there may be a somewhat larger number of manufactured homes in communities, it is nevertheless clear that most manufactured homes in Alabama are not in manufactured home communities.
- Only eight communities have been identified by Datacomp as restricted to residents over 55 years old.

Potential Opportunities for Solar for Manufactured Homes

- Investor-owned utilities are required to offer net metering.
- Relatively low electricity costs make it challenging for solar to compete.
- There are 26 rural electric cooperatives. It could be desirable to include those utilities when designing any solar program for manufactured homes.

NEW YORK

Manufactured Homes in New York

- Only a very small percentage of New York's housing units consists of manufactured homes (2.3 percent); however, because New York is a heavily populated state, there are a large total number of manufactured homes (192,909).
- The Datacomp database captures a high percentage of the manufactured homes in the state—77,038 homesites in 1,239 communities. Those homesites comprise 40 percent of the manufactured homes estimated by the US Census Bureau. But Datacomp does not have homesite data for 243 of its communities and probably also misses some communities in the state. This means that near half, if not more, of all the manufactured homes in the state are in communities.
- A large share of the communities are large. Datacomp identifies 33 that have more than 300 homesites, while another 196 have between 100–299 homesites.
- Datacomp has identified 17 resident-owned communities (ROCs) and other nonprofit communities. Eight of the ROCs, with a total of more than 800 homesites, cooperate through a network. Lakeview Village, one of the communities in the network, has completed a community solar installation to benefit the community (see case study in Chapter Four).

Potential Opportunities for Solar for Manufactured Homes

- New York is currently an attractive location for solar development, including LMI solar. Electricity rates are 8th highest in the nation, there are many state policies to encourage solar development, and the state has made a strong commitment to helping LMI households benefit from solar.
- NYSERDA and New York State Homes and Community Renewal (HCR) have embarked on an ambitious initiative to study the manufactured homes housing stock in the state and to incentivize solar development for some of those homes (see case study in Chapter Four).
- Because of the high percentage of manufactured homes in communities, especially large ones, it makes sense for solar outreach and project development to focus on those communities.
- Because the residents of the ROCs own their own land and one ROC has already developed a solar project, those communities could be compelling sites for initial installations.

- There are many municipal utilities in the state (51), which suggests that it could be desirable to give special attention to those utilities.

PENNSYLVANIA

Manufactured Homes in Pennsylvania

- Only a small percentage of Pennsylvania's housing units consists of manufactured homes (3.9 percent); however, because Pennsylvania is a heavily populated state, it has a large total number of manufactured homes (224,034).
- The Datacomp database captures a significant percentage of the manufactured homes in the state—102,107 homesites in 1,524 communities. Those homesites comprise 46 percent of the manufactured homes estimated by the US Census Bureau. But there could be more homesites, because 112 of the communities in the Datacomp database are missing homesite counts, although there could also be vacant homesites in some communities and some communities may have closed. As an approximation, roughly half the manufactured homes in the state are in communities.
- Many of the communities are large. Datacomp identifies 40 that have more than 300 homesites, while another 268 have 100–299 homesites. Among all states Pennsylvania has the 7th most communities with more than 100 homesites.

Potential Opportunities for Solar for Manufactured Homes

- With some solid solar policies, relatively high electricity rates, and virtual net metering, Pennsylvania offers sound opportunities for LMI solar development in the state.
- The state allows two types of solar development that could appeal to manufactured home communities: community solar and third-party ownership of residential systems.
- The many large communities of manufactured homes are a good target for solar outreach and project development.
- There are 29 rural electric coops and 35 municipal utilities in the state, which suggests that it could be desirable to give special attention to those utilities.

TENNESSEE

Manufactured Homes in Tennessee

- Tennessee ranks high among states in manufactured homes.
  - 272,979 manufactured homes, which is 9th among all 50 states
  - 14th among states in share of housing units that are manufactured homes (9 percent)
- Most of the state's manufactured houses are located on private property rather than in manufactured home communities.

- Datacomp has identified 668 manufactured home communities with 30,363 homesites, accounting for only 11 percent of the state's manufactured homes. Although Datacomp's database does not list a homesite count for 147 of these communities, and there may be a somewhat larger number of manufactured homes in communities, it is nevertheless clear that the vast majority of manufactured homes in Tennessee are not in manufactured home communities.
- This could make it more difficult to market a dedicated initiative for solar for manufactured homes in Tennessee than in a state where the homeowners can be easily reached because they are concentrated into manufactured home communities. On the other hand, the homeowners with homes on individually owned lots are more likely to have sufficient land around their house for a ground-mounted PV system.

- Only eight communities have been identified by Datacomp as restricted to residents over 55 years old.
- Relatively few of the communities are large. Only eight communities in the Datacomp database have more than 300 homesites, while another 75 have between 100–299 homesites.

Potential Opportunities for Solar for Manufactured Homes

- Relatively low electricity costs make it challenging for solar to compete. The state also does not allow for third-party ownership of residential PV systems.
- The Tennessee Valley Authority (TVA) plays a large role in the state and could be an important participant in bringing solar to LMI households.
- There are 23 rural electric coops and 61 municipal utilities in the state, which suggests that it could be desirable to give special attention to those utilities.

WASHINGTON

Manufactured Homes in Washington

- A modest share of Washington's housing units consists of manufactured homes (6 percent). However, Washington has a relatively large population, so there is a large total number of manufactured homes (195,923), which is the 16th most among the 50 states.
- The Datacomp database includes a large number of communities (1599), which is the 6th most among the 26 states for which we have data. The database identifies 67,264 homesites, which equals more than 34 percent of the manufactured homes estimated by the US Census Bureau. There are likely more homesites, because nearly half of the communities (757) are missing homesite data in the Datacomp database, although there could also be vacant homesites in some communities and some communities may have closed. The communities without homesite data are most likely small. On balance, it is probably the case that a modest majority of manufactured homes in Washington are on privately owned plots of land rather than in communities.

- Datacomp has identified relatively few very large communities, with only 17 having more than 300 homesites, but there are many (188) with 100-299 homesites.
- Many communities (19 percent) are restricted to residents over 55 years old.

Potential Opportunities for Solar for Manufactured Homes

- With the cheapest average electricity rates in the nation, it can be challenging for residential PV projects to be cost-effective without special incentives. However, the state has a range of favorable solar policies and state policymakers have taken steps to accelerate solar development. With an interest in advancing solar equity, there could be an appetite for developing initiatives to bring solar to manufactured homes.
- There are enough communities with more than 100 homesites to make that a logical focus for solar outreach and project development.
- With 13 rural electric coops and 41 municipal utilities, it could be desirable to give special attention to those utilities.
- Age-restricted 55+ communities could be another logical focus.

WEST VIRGINIA

Manufactured Homes in West Virginia

- West Virginia ranks 4th among states in share of housing units that are manufactured homes (12 percent).
- Most of the state's manufactured houses are located on private property rather than in manufactured home communities.
  - Datacomp has identified 404 manufactured home communities with 15,674 homesites, accounting for only 12 percent of the state's manufactured homes.
  - Although Datacomp's database does not list a homesite count for 137 of these communities, and there may be a somewhat larger number of manufactured homes in communities, it is nevertheless clear that the vast majority of manufactured homes in West Virginia are not in manufactured home communities.
  - This could make it more difficult to market a dedicated initiative for solar for manufactured homes West Virginia than in a state where the homeowners can be easily reached because they are concentrated into manufactured home communities. On the other hand, the homeowners with homes on individually owned lots are more likely to have sufficient land around their house for a ground-mounted system.
- Most of the communities in the Datacomp database are small; only one has over 300 homesites and 46 have between 100–299 homesites.
- Few of the communities (3.0 percent) have been identified by Datacomp as restricted to residents over 55 years old.

Potential Opportunities for Solar for Manufactured Homes

- Some organizations and policymakers in West Virginia are seeking to promote an energy transition that acknowledges coal's declining economic fortunes and creates job opportunities in clean energy. Initiatives related to solar for manufactured homes could be linked to that effort.
- Low average electricity costs and few policies that promote solar make it challenging for residential PV projects to be cost-effective. New special incentives would be required.
- The best opportunities for solar for manufactured homes will likely be at the many homes on individually owned lots where the homeowners own the land and have sufficient space for a ground-mounted system.

WYOMING

Manufactured Homes in Wyoming

- A significant share of the housing units in the state are manufactured homes (13 percent). This ranks 5th among states. Because Wyoming does not have a large population, the total number of manufactured homes is not large (37,425), giving Wyoming the 36th largest number of manufactured homes among states.
- The Datacomp database includes 286 communities. The database identifies 12,065 homesites, representing more than 32 percent of the manufactured homes estimated by the US Census Bureau. There are likely more homesites because nearly half of the communities (136) are missing homesite data in the Datacomp database, although there could also be vacant homesites in some communities and some communities may have closed. The communities without homesite data are most likely small. On balance, it is probably the case that most manufactured homes in Washington are on privately owned plots of land rather than in communities.
- Five of the communities have more than 300 homesites and 35 communities have between 100 and 199 homesites.
- Few of the communities (3.1 percent) have been identified by Datacomp as restricted to residents over 55 years old.

Potential Opportunities for Solar for Manufactured Homes

- Low average electricity costs and few policies that promote solar make it challenging for residential PV projects to be cost-effective. New special incentives would be required.
- For a small state, there are enough large communities with more than 100 homesites to make that a logical focus for an initiative for solar for manufactured homes.

APPENDIX C

Methodology for Analyzing Data on Manufactured Home Communities

Information used in this report for 24,395 individual manufactured home communities was provided by Datacomp Appraisal Services. For the analysis of those communities, researchers used Datacomp's reported figures for each community listed, although some attributes fields were incomplete. Datacomp listed the community's location, the number of sites within the community, and whether it was age-restricted or resident-owned. Explanations of adjustments made to accommodate missing data appear later in this appendix.

UTILITY DATA

To supplement the Datacomp information and determine opportunities to offer solar programs, the project team added utility fields. Using the listed address for each community entry, colleagues at Lawrence Berkeley National Laboratory determined the latitude and longitude to determine the electric utility companies that serve those locations. The approach used a combination of Google Maps for latitude and longitude, as well as the Census Bureau's block latitude and longitude. The associated utilities were generated based on those coordinates. A community could have up to three electric service companies listed. The team then cleaned those utility lists to remove double-counted entries and also removed companies that were incorrectly generated due to a geocoding error.

HOUSEHOLD INCOME DATA

To identify manufactured home communities that are LMI, we needed to understand their income relative to surrounding geographic areas. Individual incomes are protected for privacy, so to estimate the median income of the residents of a manufactured home community, researchers created a proxy using the community's corresponding census tract Median Household income according to the 2019 American Community Survey (ACS).[1] Specifically, they used ACS Table B19013, "Median Household Income in the Past 12 Months (In 2019 Inflation-Adjusted Dollars)".

The Datacomp data reported census block IDs that we converted to census tract IDs. It should be noted that not all communities included geographies and were therefore omitted from parts of the analysis. The corresponding median household income was matched for the tract, county, CBSA, and state level for all communities in this analysis.

1 U.S. Census Bureau, "American Community Survey," *https://www.census.gov/programs-surveys/acs.*

For the county-level income data, the US Census Bureau's 2019 Small Area Income and Poverty Estimates (SAIPE) was used. This table was selected because

> "The main objective of this program is to provide estimates of income and poverty for the administration of federal programs and the allocation of federal funds to local jurisdictions. In addition to these federal programs, state and local programs use the income and poverty estimates for distributing funds and managing programs…. Prior to the creation of the SAIPE program the decennial census was the only source of income distribution and poverty statistics for households, families, and individuals if one needed data for "small" geographic areas, e.g., counties, cities, and other substate areas. The ten-year span between the release of decennial census data left a large gap in information concerning fluctuations in the economic situation of the nation and local areas."[2]

To get as accurate income estimates as possible for the rural areas of our analysis, the team determined the SAIPE table to be useful for county-level median income and to validate the estimates from 2019 ACS estimates in table B19013.

Additionally, researchers sourced data from IPUMS's National Historical Geographic Information System[3] to validate the ACS findings and to include median household income at the summary level Core Based Statistical Area (CBSA). According to the Census Reporter Glossary, Technically, CBSAs are either metropolitan or micropolitan statistical areas—both describe a specific group of counties (or sometimes just one county) around an urban core."[4]

US Census Bureau ACS figures in this report such as household income, population, or mobile home tenure all used the 2019 five-year survey for all geography levels for consistency. The state maps of all manufactured homes by county are based on ACS Table B25024, "Units in Structure" and selecting "Mobile home" for housing stock.[5]

Although the Datacomp data on individual communities is proprietary and not permitted for publication, all other external data we used for calculations and analyses in this report are publicly and freely available.

CATEGORIZING COMMUNITIES

Each manufactured home community as reported by Datacomp was placed into distinct groups based on observable attributes. This analysis groups communities by income level, total site counts, and if they had a confirmed age-restriction. The AMI category used the external US Census Bureau ACS income estimates based on the community's geography and the other categories used the corresponding Datacomp figures.

Researchers placed the manufactured home communities into categories based on the comparison of tract-level income to other surrounding geographies to calculate the community's AMI. For "low-income," the most common definition was used, which is having a household income

2 U.S. Census Bureau, "SAIPE". *https://www.census.gov/programs-surveys/saipe/about.html.*

3 Steven Manson, Jonathan Schroeder, David Van Riper, and Steven Ruggles. IPUMS National Historical Geographic Information System: Version 14.0 [Database]. Minneapolis, MN: IPUMS. 2019. *http://doi.org/10.18128/D050.V14.0.*

4 Census Reporter, "Glossary," https://censusreporter.org/glossary/#term-cbsa.

5 Census Reporter, "Housing," *https://censusreporter.org/topics/housing.*

of less than 80 percent of AMI. "Moderate income" represents 80-100 percent of AMI. "Low-and-moderate income" (LMI) communities are the inclusive grouping and include any community with an estimated less-than 100 percent of AMI. To determine a community's AMI, the team started with the CBSA and switched to county median income if CBSA data was not available, which was the case for some rural areas. They also categorized communities compared to their respective state's median household income.

Manufactured home communities were further subdivided and categorized by their site counts. Communities with 49 or less mobile home or manufactured home residences were labeled "Small," communities with 50-99 sites were "Medium," and communities with 100 or more sites were labeled "Large."

Communities that were marked by Datacomp with a confirmed age-restriction were labeled accordingly. To unpack trends within LMI residents of these communities and between states analyzed in this report, the team would use the community categories to draw comparisons.

MISSING DATA

Some calculations may suffer from bias due to omitted observations in the raw data. Some attributes for communities in every state were not provided by Datacomp. Therefore, not all communities have site counts, have geographic identifiers (ID tag), or an associated electric utility. When a utility was removed due to a duplicate entry or a geocoding error, it was not replaced with the correct utility. Similarly, for communities lacking a geo-ID that were not matched with a tract-level median income, missing data points were not replaced.

Calculations were adjusted to filter out communities that lacked the appropriate data to maintain appropriate comparisons. In absence of corresponding CBSA, the county-level median income was used to estimate a community's AMI.

Although there are missing observations in the data, the authors feel confident that the influence of missing data is not enough to significantly alter the results of the report's assessment. When data for the fourteen states was separated from the original Datacomp spreadsheet, there were an average of 1,742 community entries and a median 1,091 community entries per state. Ultimately, there are sufficient quantitative and qualitative data to make meaningful interpretations and general take-aways for the purposes of this report. Additional research and income data could certainly enhance and expand on the findings in the income-related analyses of this report.

SCALING UP SOLAR FOR UNDER-RESOURCED COMMUNITIES PROJECT

CESA's *Solar for Manufactured Homes* report was produced as part of the *Scaling Up Solar for Under-Resourced Communities Project,* a three-year effort to accelerate solar development that will benefit low-to-moderate income (LMI) households and communities. The project focuses on three distinct subsets of the LMI solar market: single-family homes, multifamily affordable housing, and manufactured homes. You can learn more about the project on its webpage at www.cesa.org/projects/scaling-up-solar-for-under-resourced-communities/single-family-homes.

As a follow-up to this two-volume report, the manufactured homes component of the project will continue to share information about solar for manufactured homes in 2021–2022. CESA is sponsoring a learning network for state policymakers, utilities, solar industry representatives, manufactured homes associations, and other interested stakeholders who want to be invited to virtual events to learn more about the topic. To receive invitations to learning network events, write to CESA Project Manager Wafa May Elamin at wafamay@cleanegroup.org and include "Learning Network" in the subject line.

CESA will also launch a working group of state agencies and utilities that want to explore developing pilot solar projects that benefit manufactured homes residents. To find out more about this working group or to join it, email wafamay@cleanegroup.org and include "Work Group" in the subject line.

The *Scaling Up Solar for Under-Resourced Communities Project* is funded in part by the US Department of Energy Solar Energy Technologies Office, which supports early-stage research and development to improve the affordability, reliability, and domestic benefit of solar technologies on the grid. You can learn more at energy.gov/solar-office.

OTHER CESA RESOURCES ON LMI CLEAN ENERGY

Since 2013, CESA has carried out initiatives to help state governments and other stakeholders implement solar and other clean energy technologies in ways that bring tangible benefits to LMI households and communities. Those initiatives have produced a wide range of guides, case studies, and other resources that are all available on the CESA website, www.cesa.org. Here are two notable examples:

- Directory of State Low- and Moderate-Income Clean Energy Programs
- Solar with Justice: Strategies for Powering Up Under-Resourced Communities and Growing an Inclusive Solar Market

CESA also produces the Solar Equity Digest, a free, monthly e-newsletter with news and resources from around the country on bringing the benefits of solar electricity to LMI communities. You can sign up at www.cesa.org/newsletters.

The Clean Energy States Alliance (CESA) is a national, nonprofit coalition of public agencies and organizations working together to advance clean energy. CESA members—mostly state agencies—include many of the most innovative, successful, and influential public funders of clean energy initiatives in the country.

Ørsted US Offshore Wind/Block Island Wind Farm

Clean Energy States Alliance

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