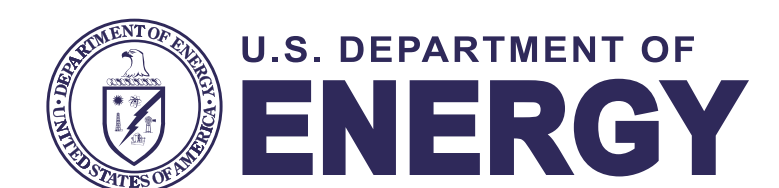




Income Trends among U.S. Residential Rooftop Solar Adopters

Galen Barbose, Sydney Forrester, Naïm Darghouth, and Ben Hoen
February 2020

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Outline

- Overview
- Summary of Key Findings
- Data and Geographical Coverage
- Results
 - Comparing PV Adopters to the Broader Population
 - Temporal Trends
 - Geographical Trends
 - Trends for Low-to-Moderate Income (LMI) Households
 - Other Financial Indicators: Home Values and Credit Scores
- Conclusions
- Appendix

Overview

Report produced as part of a new Berkeley Lab initiative to track and analyze demographic trends of residential solar adopters

- Pairs Berkeley Lab's *Tracking the Sun* dataset and other sources of PV addresses with household-level income data
- Focuses on residential rooftop solar photovoltaic (PV) systems, with an emphasis on 2018 installations
- Focuses primarily on income, though later work will describe trends related to other demographic attributes
- Analysis is descriptive in nature: intended to track basic trends and to serve as a foundational resource for further analyses and support for market participants
- Report is published in slide deck form with accompanying online data visualizations that allow users to further explore the data (see solardemographics.lbl.gov)

Key Findings

- **Income distribution of 2018 residential solar adopters:** 15% have household incomes <\$50k, 33% are between \$50-100k, 24% are between \$100-150k, and the remaining 28% are ≥\$150k
- **Temporal trends:** Households (HHs) with incomes <\$100k grew from 39% of solar adopters in 2010 to 48% in 2018, while those with incomes ≥\$200k dropped from 26% to 16%
- **Comparisons to broader population:** 18% of 2018 solar adopters are below the national median HH income, while 30% are below the median for owner-occupied households (OO-HHs)
- **Geographic variation:** Typically 25-50% of 2018 solar adopters are below the state median income for OO-HHs, though there are 3 states and 42 counties in the dataset where >50% of 2018 solar adopters are below the corresponding OO-HH median income
- **Low-to-moderate income households:** 6% of 2018 solar adopters have incomes <150% of the federal poverty level (FPL), while 21% are <300% of FPL; 15% are <80% of the area median income (AMI), while 30% are <120% of AMI
- **Other financial indicators:** Among 2018 solar adopters, 27% have home values below their respective county median, and 35% have credit scores below their state median

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Data

- **Berkeley Lab's Tracking the Sun dataset**

- ▣ Street addresses for 1.2 million PV systems installed through 2018 across 22 states
- ▣ Sourced primarily from utilities and state agencies

- **BuildZoom**

- ▣ Proprietary building permit database serving as a supplementary source of PV street addresses
- ▣ Expands PV address sample by an additional 200k systems, extending into 14 additional states

- **Experian modeled *household* values, matched to solar PV addresses**

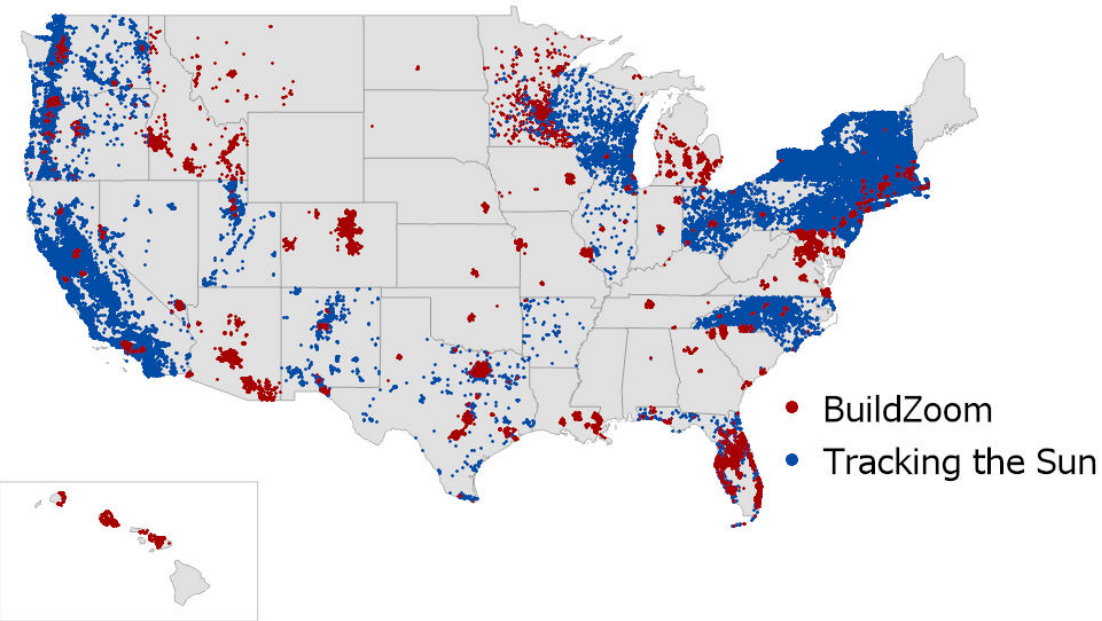
- ▣ Household income
- ▣ Home value
- ▣ Credit scores

*Q1 2019 values (not for the date of PV installation)
See appendix slide 38 for further definition and details*

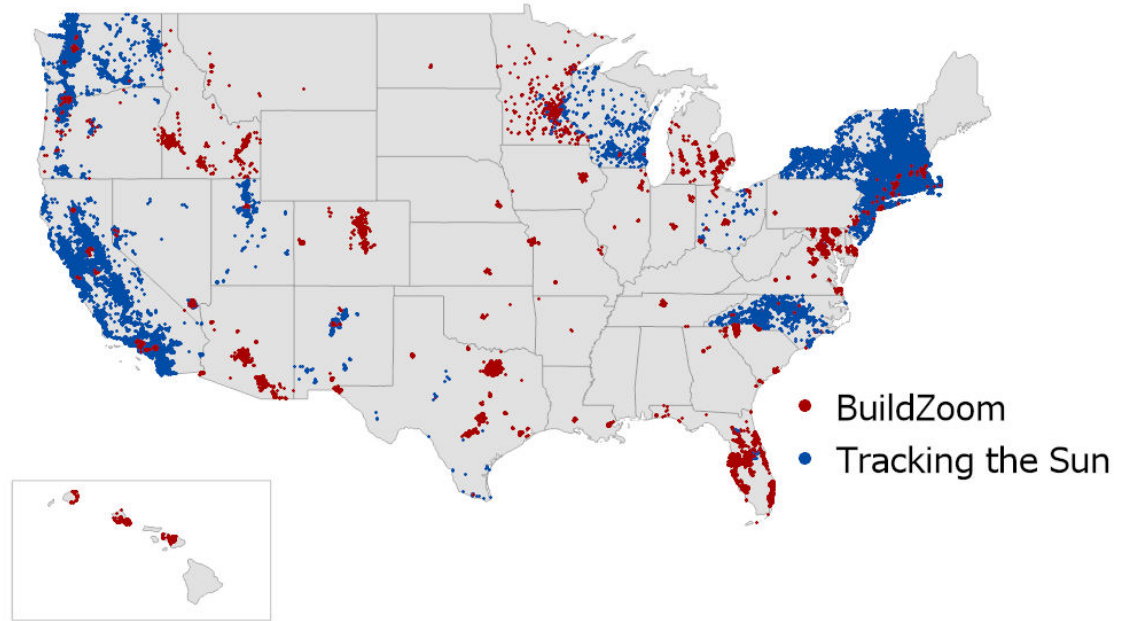
- **U.S. Census data (2013-2017 American Community Survey 5-year estimates)
used for comparisons to broader population**

Geographical Coverage

All Systems in Sample



2018 Systems Only



- 1.4M systems cover 73% of all U.S. residential systems through 2018 and 68% of systems installed in 2018
- Sample skews slightly towards higher income states, relative to the total U.S. residential PV market

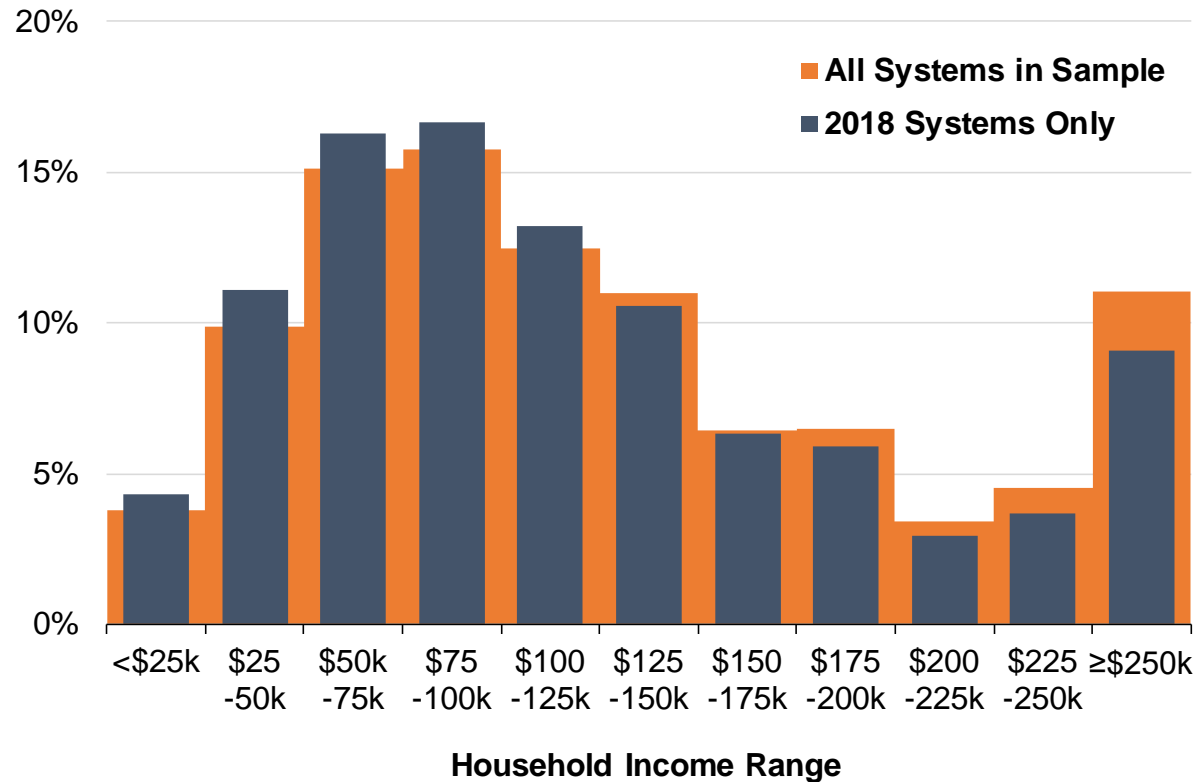
See appendix slides 33-37 for further details on sample sizes and associated market coverage

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Solar-Adopter Household Income Distributions

Percent of Solar Adopters

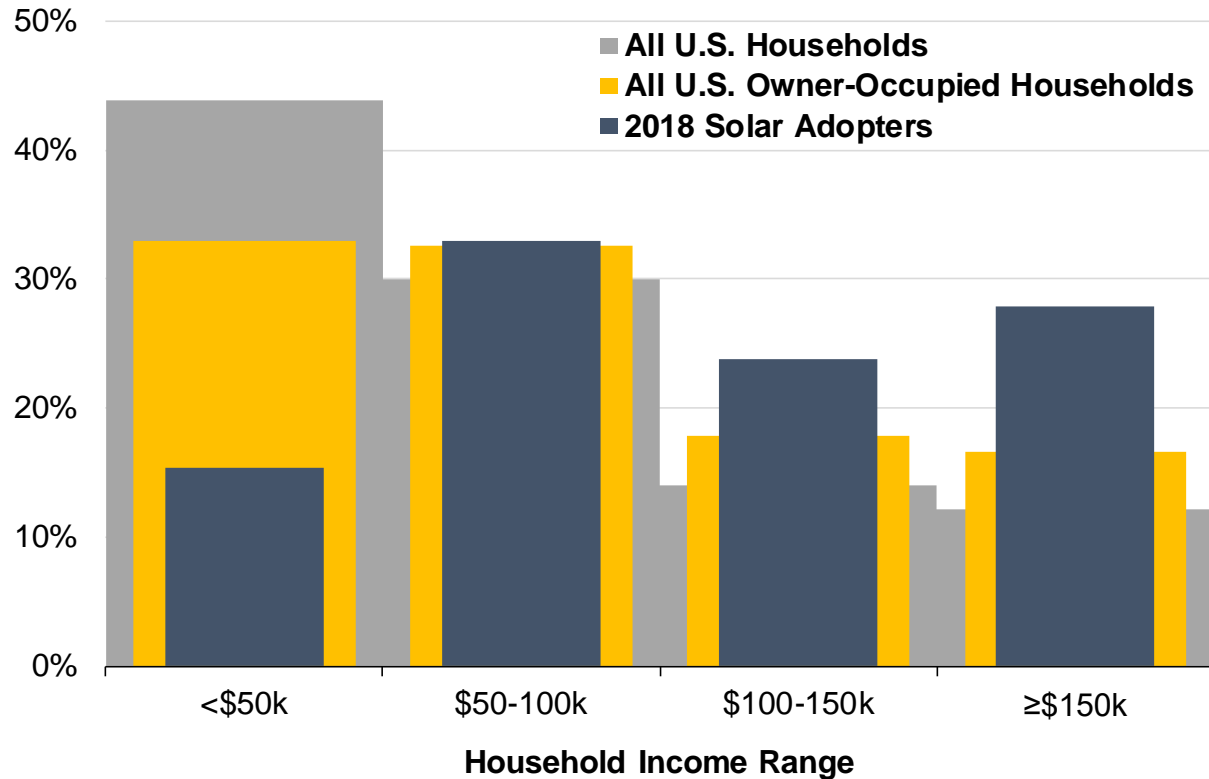


Notes: Experian income estimates represent 2019 household incomes of the current residents of each solar home, irrespective of when the PV installation occurred. These estimates thus may not reflect household incomes at the time the PV system was installed, or could even be based on an entirely different set of occupants, particularly for older systems.

- Solar adopters span all income ranges
- Distribution peaks between \$50-100k, but has a long upper tail
- Among 2018 solar adopters:
 - ▣ 15% have household (HH) incomes <\$50k
 - ▣ 33% are between \$50-100k
 - ▣ 24% are between \$100-150k
 - ▣ 28% are ≥\$150k
- Comparing the two distributions suggests that solar adoption has shifted slightly toward lower incomes over time (later slides delve into this trend more fully)

Income Distribution of Solar Adopters vs. U.S. Population

Percent of Households

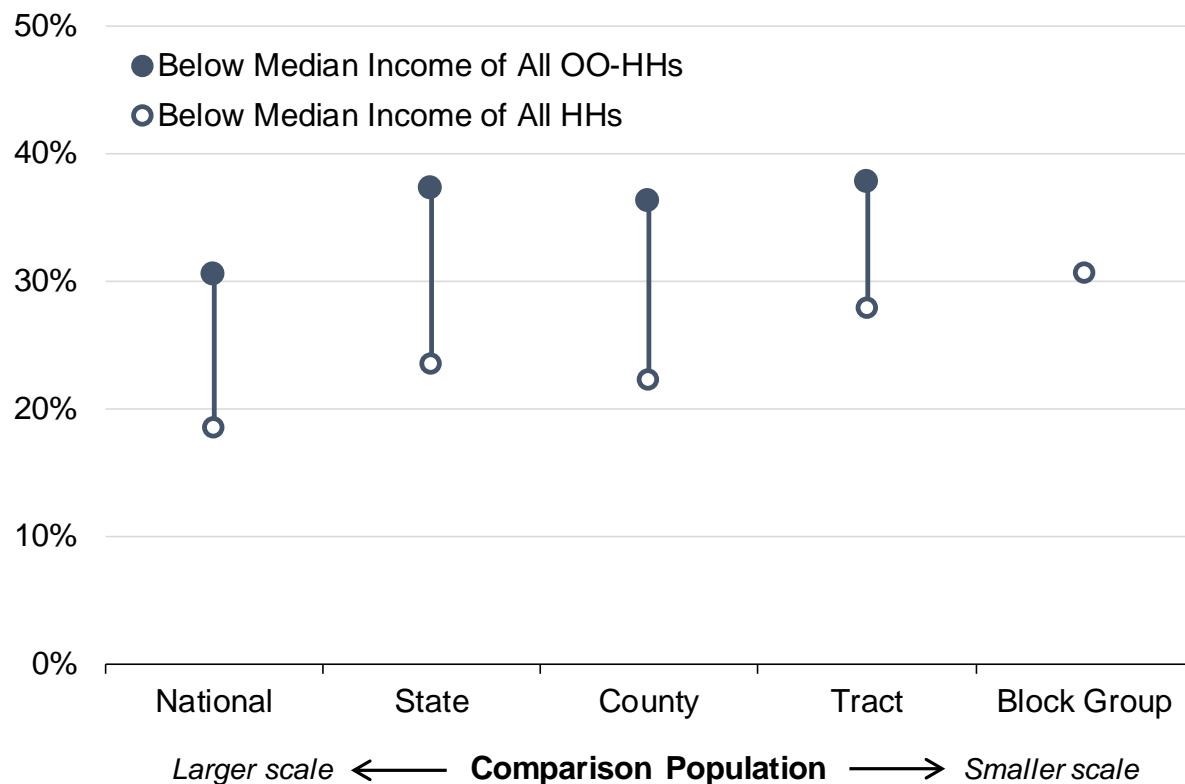


Notes: Based on all states in the data sample. Incomes are consolidated into this set of bins in order to conform to Census statistics, which are provided in \$50k increments for incomes ≥\$100k, and which group all incomes ≥\$150k for owner-occupied households.

- Comparing to Census data requires that we consolidate the income bins, as shown here
- Solar-adopter incomes skew high relative to all U.S. households
 - ▣ Income disparities are most pronounced at the low and high ends
 - ▣ Whereas HHs with incomes in the \$50-100k range are proportionately represented
- Skew is less pronounced if comparing to just owner-occupied households (OO-HHs)
 - ▣ Solar adoption occurs primarily among single-family owner-occupied homes (due to owner-control of rooftop, owner/tenant split incentive)
 - ▣ Illustrates how home-ownership can be a key driver for income disparities between solar adopters and the broader population

Percent of Solar Adopters Below Median HH Income at Varying Spatial Scales

Percent of 2018 Solar Adopters



Notes: To construct the figure, the estimated HH income for each solar adopter was compared to the median income of all HHs and OO-HHs in the U.S. and in the corresponding state, county, census tract, and census block group. Note that census data for block-group median incomes are available for all HHs, but not for just OO-HHs.

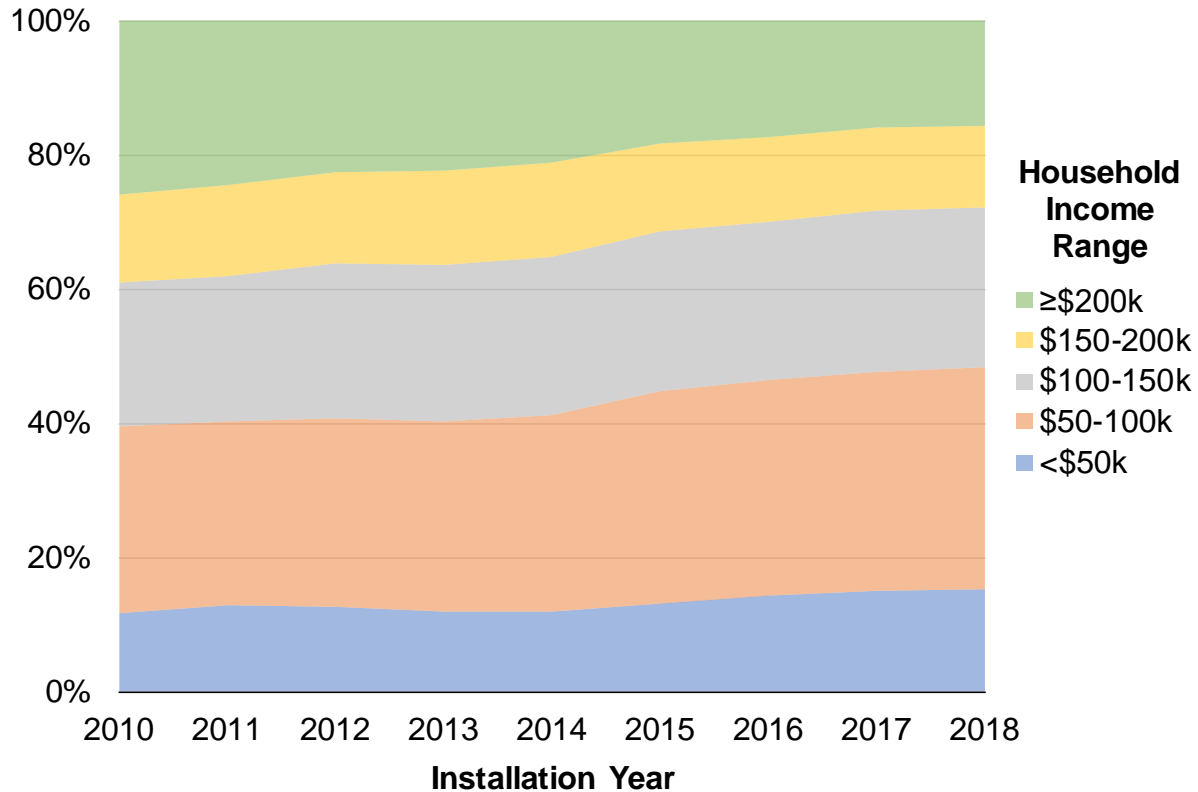
- At progressively finer spatial scales, solar adopters look increasingly like other HHs
 - ▣ 18% are below the national median income for all HHs, but 31% are below the median for HHs in the same census block group
 - ▣ Among OO-HHs, 30% of solar adopters are below the median income nationally vs. 38% at the census tract-level
- Some income disparities may thus be driven by larger macro-dynamics in terms of where and how solar markets develop
 - ▣ E.g., higher-income states; suburban vs. rural; peer effects seeded in high-income areas
- Disparities clearly exist at local scales as well (e.g., within tracts and block groups)

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Solar-Adopter Income Trends over Time

Percent of Solar Adopters



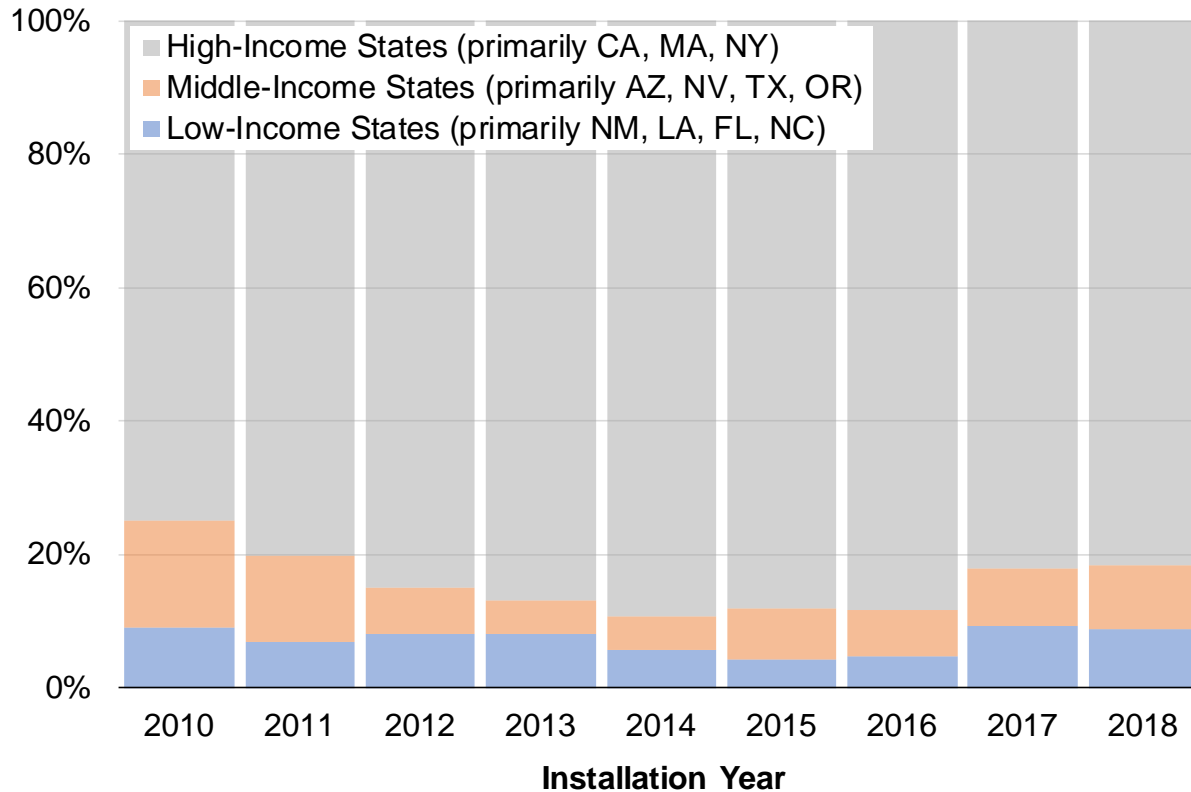
Notes: Income estimates represent 2019 household incomes of the current residents of each solar home, irrespective of when the PV installation occurred. Current residents could differ from occupants at the time the system was installed, particularly for older systems.

- Solar adoption has been slowly migrating toward lower incomes (at least since 2010*)
 - ▣ Sample share of HHs with incomes <\$100k grew from 39% to 48% over 2010-2018, with most pronounced shift since 2014
 - ▣ While share of HHs with incomes ≥\$200k dropped from 26% to 16%
- May reflect some combination of:
 - ▣ Falling PV prices
 - ▣ Greater range of financing options
 - ▣ Programs targeting LMI households
 - ▣ Maturing PV markets

**Pre-2010 trends, not shown here, are somewhat volatile, partly due to small sample sizes*

Distribution of Solar Adopters by State Median Income

Percent of Solar Adopters



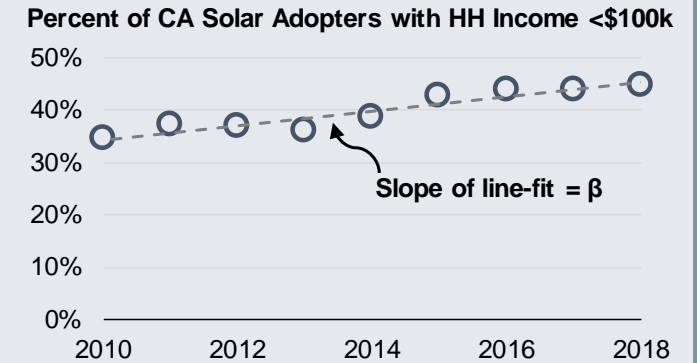
Notes: State income groups are defined by comparing the median income of all OO-HHs in each state to all other states in the data sample, where Low-, Middle-, and High-Income correspond to the lower, middle, and upper third of states. See the appendix slide 37 for an analogous graphic based on the total population of U.S. residential systems.

- The figure shows the distribution of solar adopters across states, based on the median income of all OO-HHs in the corresponding state (using Census data)
- The overwhelming majority of systems are installed in “high-income” states, driven by CA
- But that trend has diminished slightly since 2014, as solar markets have expanded in a number of middle- and lower-income states
- This trend may *partly* explain the general migration of solar adoption toward lower income households, at least since 2014
- But solar adoption is also generally migrating toward lower income households *within* individual states, as shown on the next slide

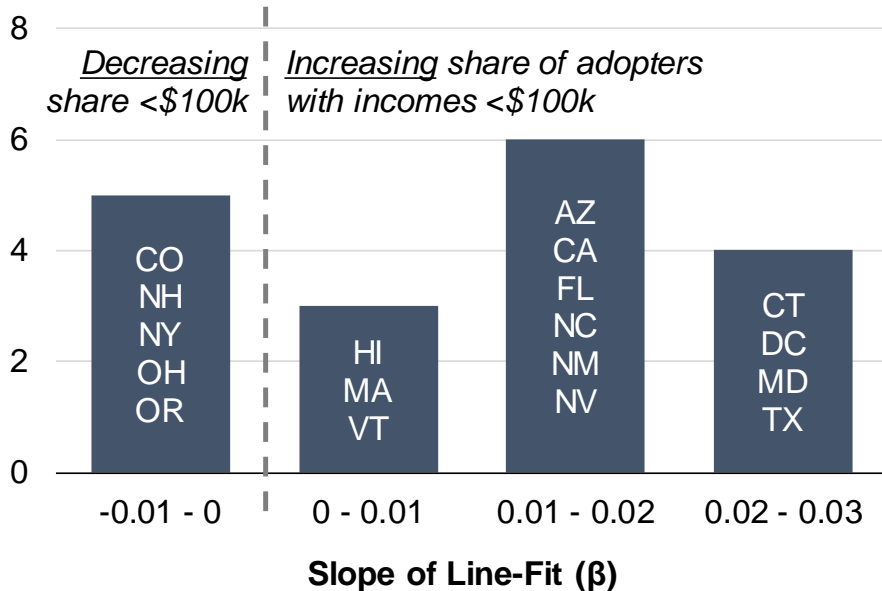
Share of Adopters with Incomes <\$100k

Trends over Time by State

- For each state, we calculate the percentage of solar adopters with incomes <\$100k in each year (the example to the right is for CA)
- The slope (β) of the line fit to those annual percentages for each state indicates whether adoption is generally moving toward lower ($\beta > 0$) or higher ($\beta < 0$) income HHs over time



Number of States



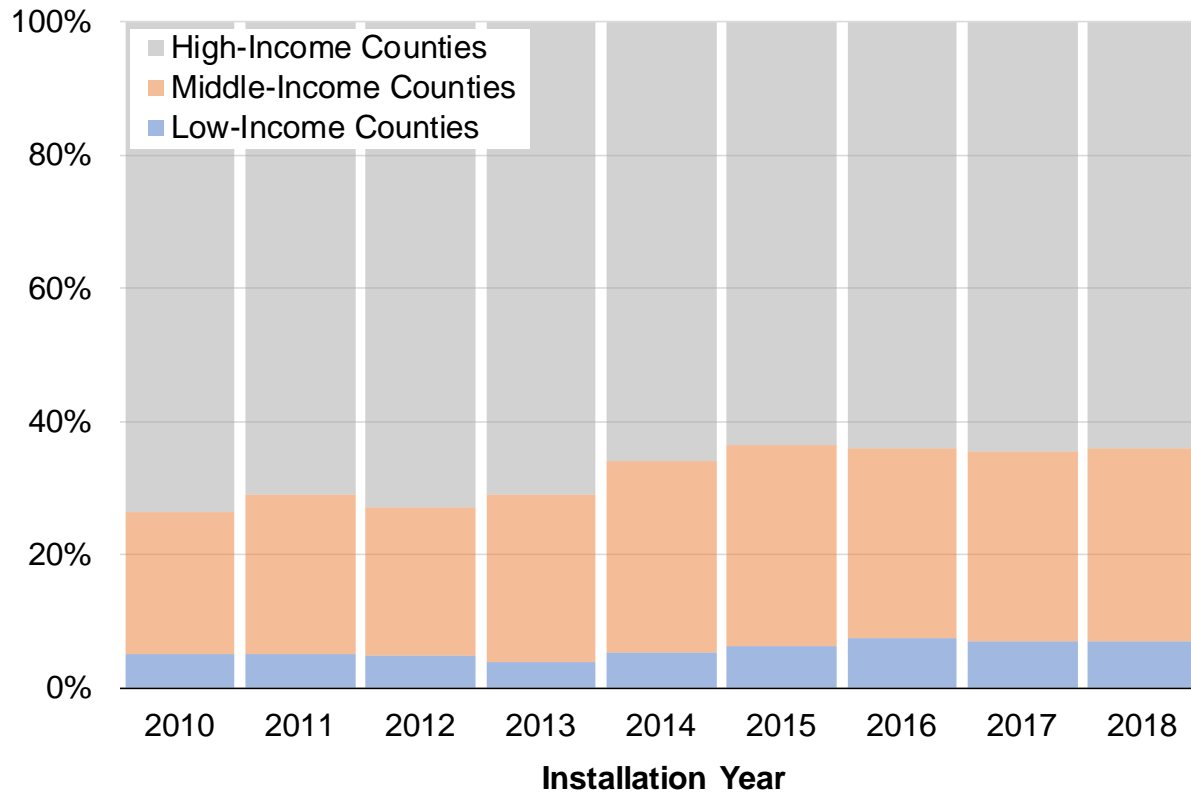
Focusing on the 2010-2018 period and those states with at least 100 systems in each year:

- In 13 of 18 states, adoption migrated toward lower income HHs ($\beta > 0$), though to varying degrees
- Trends are robust to other income thresholds (\$50k, \$150k) instead of \$100k

See appendix slide 40 for time trends among a select set of states, and see online data visualizations for other state-level time trends

Distribution of Solar Adopters by County Median Income

Percent of Solar Adopters



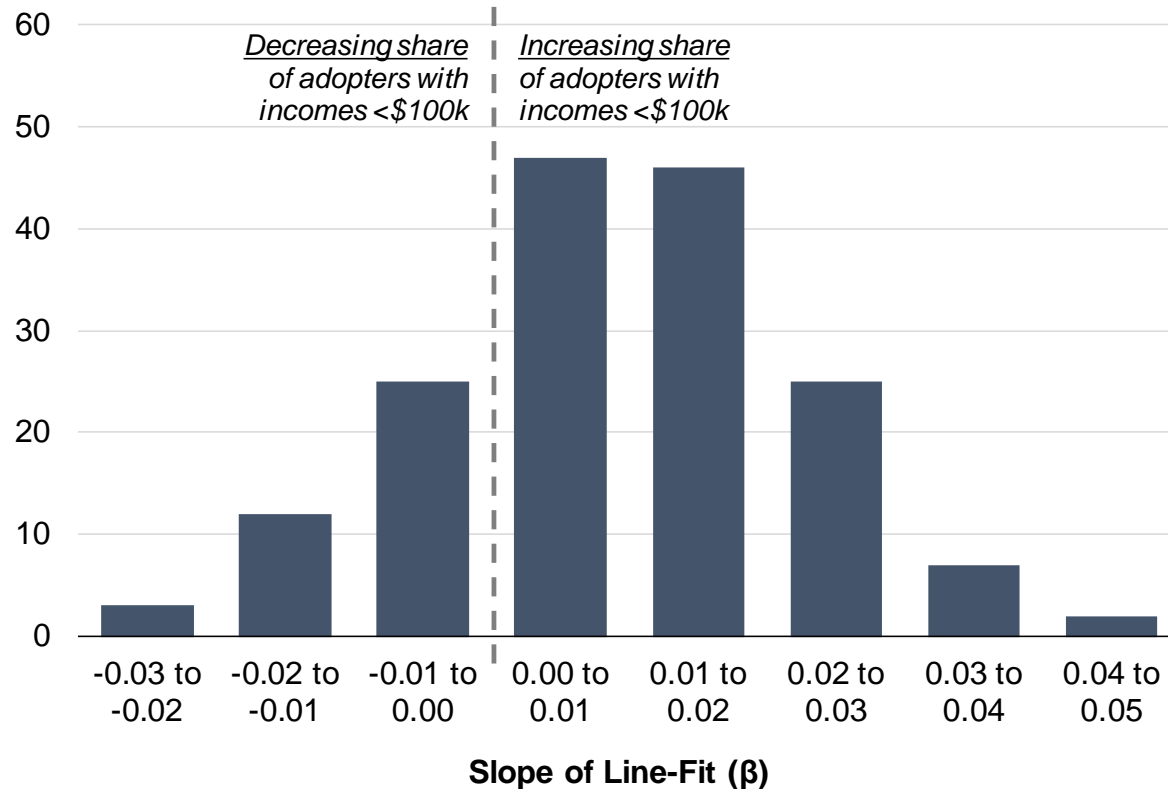
Notes: County income groups are defined by comparing the median income of all OO-HHs in each county to other counties in the same state, where Low-, Middle-, and High-Income correspond to the lower, middle, and upper third of counties.

- Within individual states, adoption tends to be concentrated in the highest income counties in the same state
 - ▣ Partly a function of population density
- This trend has moderated slightly over time, at least in aggregate, with an increasing share of adopters in middle- and low-income counties
 - ▣ That shift is most evident over 2010-2015
 - ▣ Trends at the individual state level are more mixed (not shown here)
- This modest broadening of solar adoption toward lower-income counties may also contribute to the more general trend of greater adoption by lower-income HHs

Share of Adopters with Incomes <\$100k

Trends over Time by County

Number of Counties



Notes: For each county, we calculate the percentage of solar adopters with incomes <\$100k in each year. The slope (β) of the line fit to those annual percentages for each county indicates whether adoption is generally moving toward lower ($\beta > 0$) or higher ($\beta < 0$) income HHs over time. This analysis focuses on the 2010-2018 period and includes only those counties with at least 10 systems in each of those years.

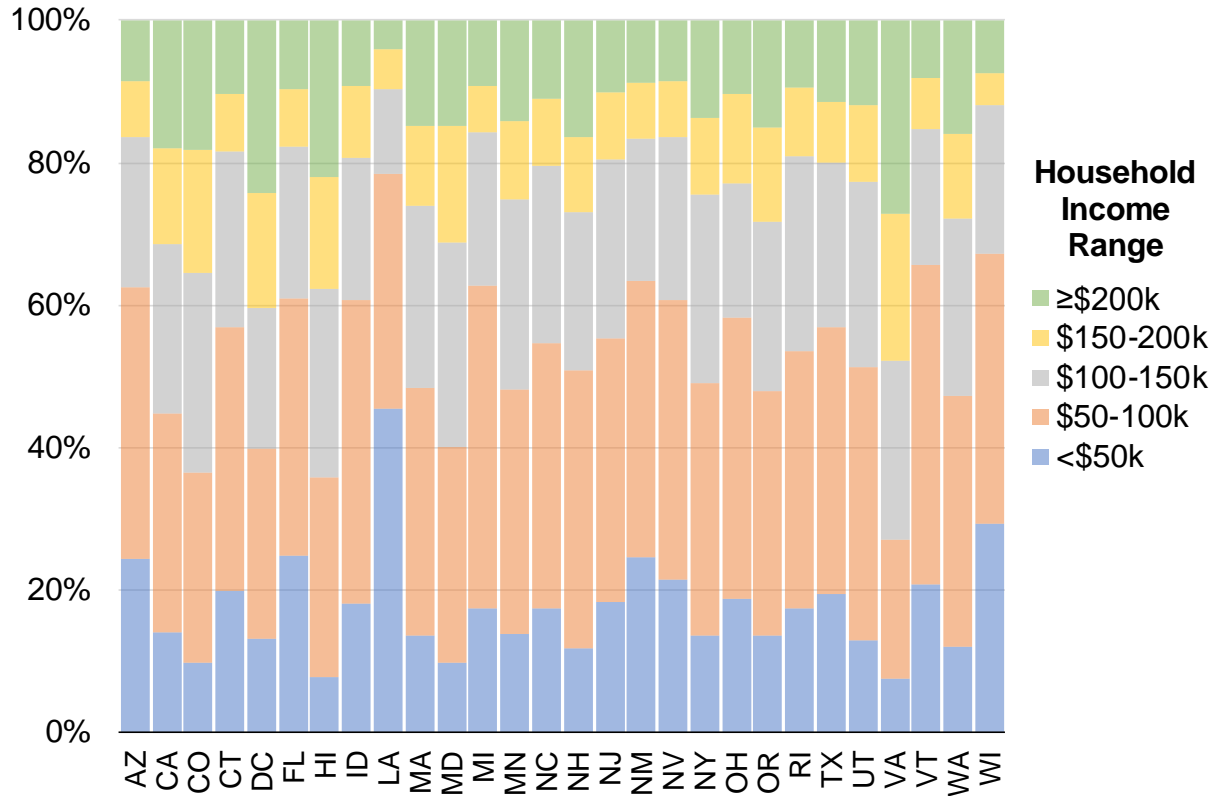
- We perform line-fits of the share of adopters with incomes <\$100k over time at the county level, similar to the earlier state-level analysis
- As with the state-level analysis, most counties (127 out of 167) exhibit an increasing share of solar adopters with incomes <\$100k over time
- Collectively, these findings confirm that the general trend of solar adoption migrating toward lower income HHs reflects both:
 - ▣ **Broadening** of U.S. solar markets into progressively lower income states/counties, and
 - ▣ **Deepening** of solar markets as they reach progressively lower income HHs within individual local markets

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Solar-Adopter Income Distributions Across States

Percent of 2018 Solar Adopters



Notes: The figure excludes states for which the dataset contains fewer than 100 systems or less than 10% market coverage in 2018 (see appendix slide 35 for sample size and market coverage by state).

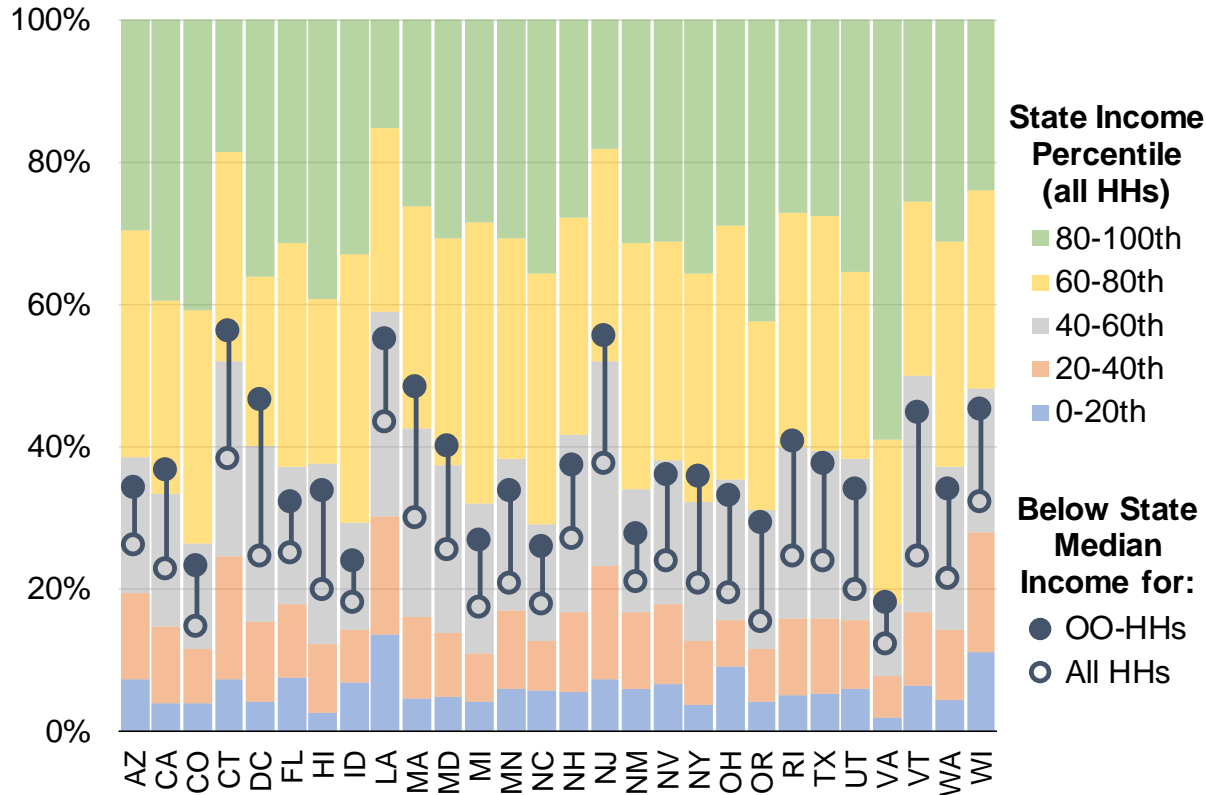
- Solar-adopter income distributions vary across states, but in general, roughly:
 - ▣ 30-40%* of 2018 solar adopters have HH incomes in the \$50-100k range
 - ▣ 10-20% have incomes \geq \$200k
 - ▣ 10-25% have incomes $<$ \$50k
- Some notable exceptions (e.g., LA, VA)
- Differences across states can reflect:
 - ▣ Relative levels of solar market maturity
 - ▣ Utility rates and solar incentives, including LMI-oriented programs
 - ▣ Overall income levels in the state (or portion of the state for which data are available)

* The ranges cited on this slide all refer to the 10th to 90th percentile range among states for each respective metric

Solar-Adopter Income Distributions Across States

Relative to State Median Income and Percentiles

Percent of 2018 Solar Adopters

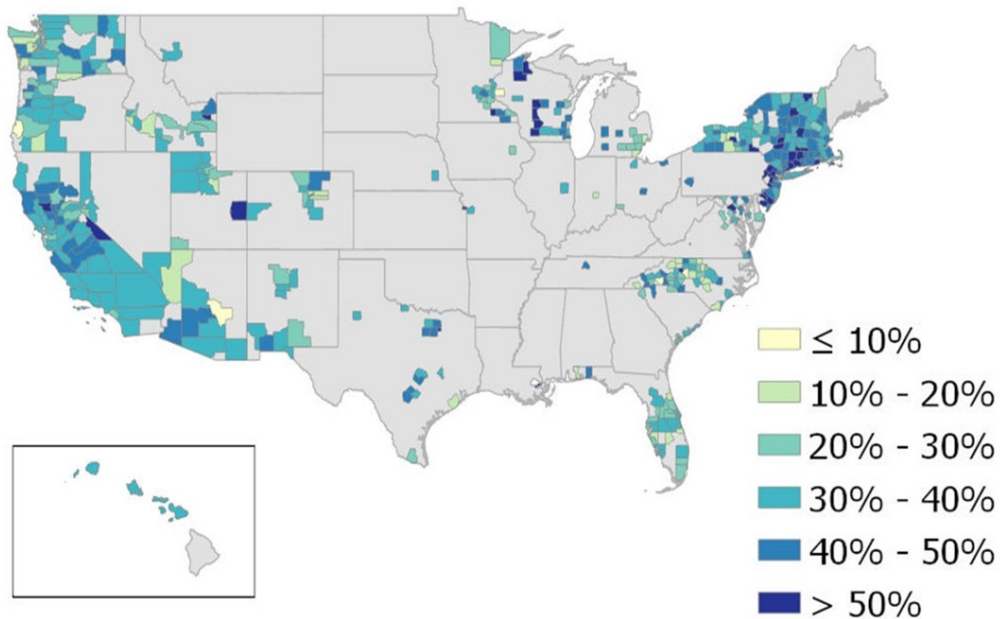


Notes: The figure excludes states for which the dataset contains fewer than 100 systems or less than 10% market coverage in 2018 (see appendix slide 35 for sample size and market coverage by state). State income percentiles are not available specifically for OO-HHs

- Solar-adopter income distributions vary across states on a relative basis, and generally skew high compared to the overall population
 - ▣ Typically 15-35% of solar adopters are below the statewide median income of all HHs or 25-50% if compared to just OO-HHs
 - ▣ HHs in the bottom two state income quintiles (<40th percentile) typically comprise 10-25% of adopters, while HHs in the top two quintiles (>60th percentile) comprise 50-75%
- Several states (CT, LA, NJ) exhibit “income parity”, where at least 50% of 2018 solar adopters are below the statewide median income for OO-HHs
 - ▣ Even in those cases, though, the lowest income percentiles are still under-represented

Solar Adopters Compared to Median County Incomes

Percent of 2018 Solar Adopters Below the County Median Income for All OO-HHs



Notes: The map shows data for the 448 counties with at least 10 observations in 2018.

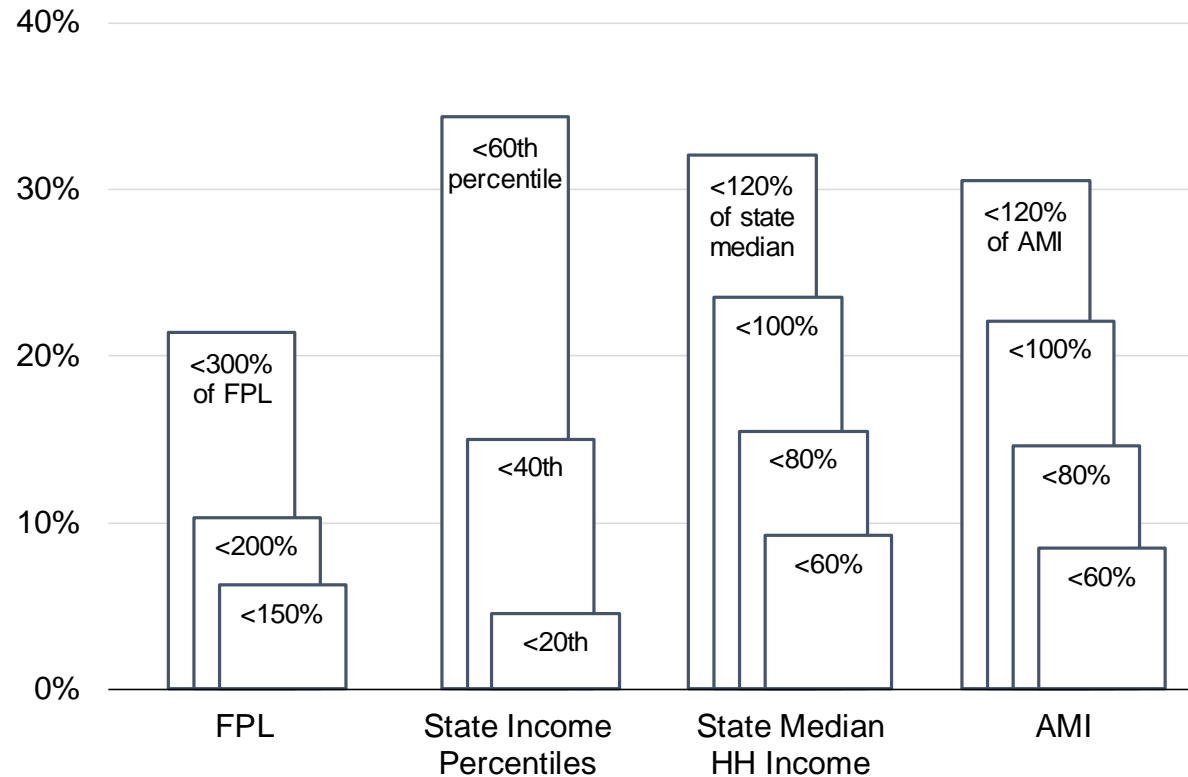
- Across individual counties, typically 20-50% of 2018 solar adopters are below the county median income for OO-HHs
- Income parity evident in 42 counties where >50% of 2018 solar adopters are below the county median OO-HH income
 - ▣ Includes counties in 16 states, with the largest contingents in NJ (11 counties) and WI (6)
 - ▣ Also includes counties in states in which solar-adopter incomes otherwise skew relatively high (e.g., ID, NC)
- More generally, county-level solar adopter income distributions can vary significantly within individual states
 - ▣ Drilling down to census tracts or block-groups reveals even greater variability

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LMI Sample Shares under Varying LMI Definitions

Percent of 2018 Solar Adopters Below Identified LMI Threshold



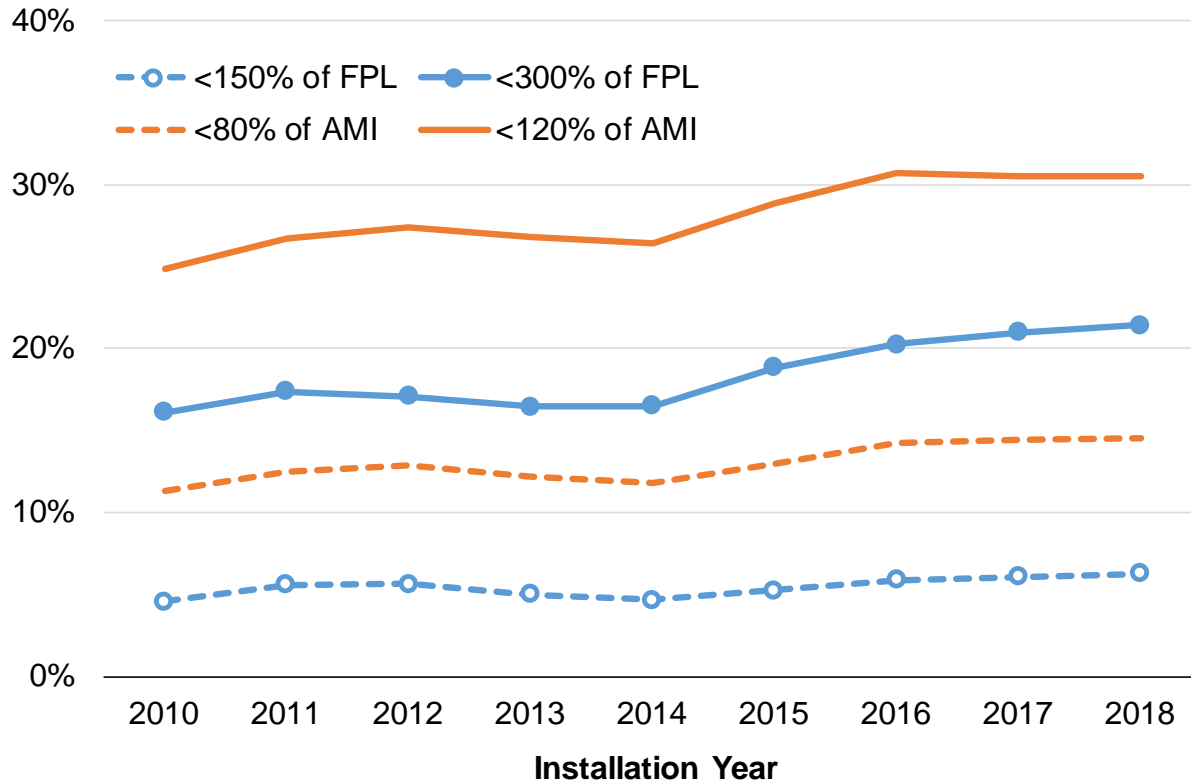
Notes: Based on all systems in the data sample. Comparison populations for each metric are based on all HHS, regardless of home-ownership. The values shown for FPL are based on the 2018 FPL for a family of three (\$20,780 for the 48-contiguous states; \$23,900 for Hawaii).

- Various income metrics and thresholds are used to define LMI:
 - ▣ 150% or 200% of FPL* are common (e.g., LIHEAP* and WAP*)
 - ▣ 80% of AMI* is also frequently used (e.g., California's SASH* program, WAP, HUD*)
 - ▣ Some states use a percent of state median income (e.g., 70% in OR)
 - ▣ 300% of FPL and 120% of AMI are sometimes used to include moderate income
- Across all 2018 solar adopters
 - ▣ FPL: 6% are <150%, 21% are <300%
 - ▣ AMI: 15% are <80%, 30% are <120%

* FPL = Federal Poverty Level, LIHEAP = Low Income Home Energy Assistance Program, WAP = Weatherization Assistance Program, AMI = Area Median Income, SASH = Single-Family Affordable Solar Homes, HUD = Department of Housing and Urban Development

LMI Sample Share over Time

Percent of Solar Adopters

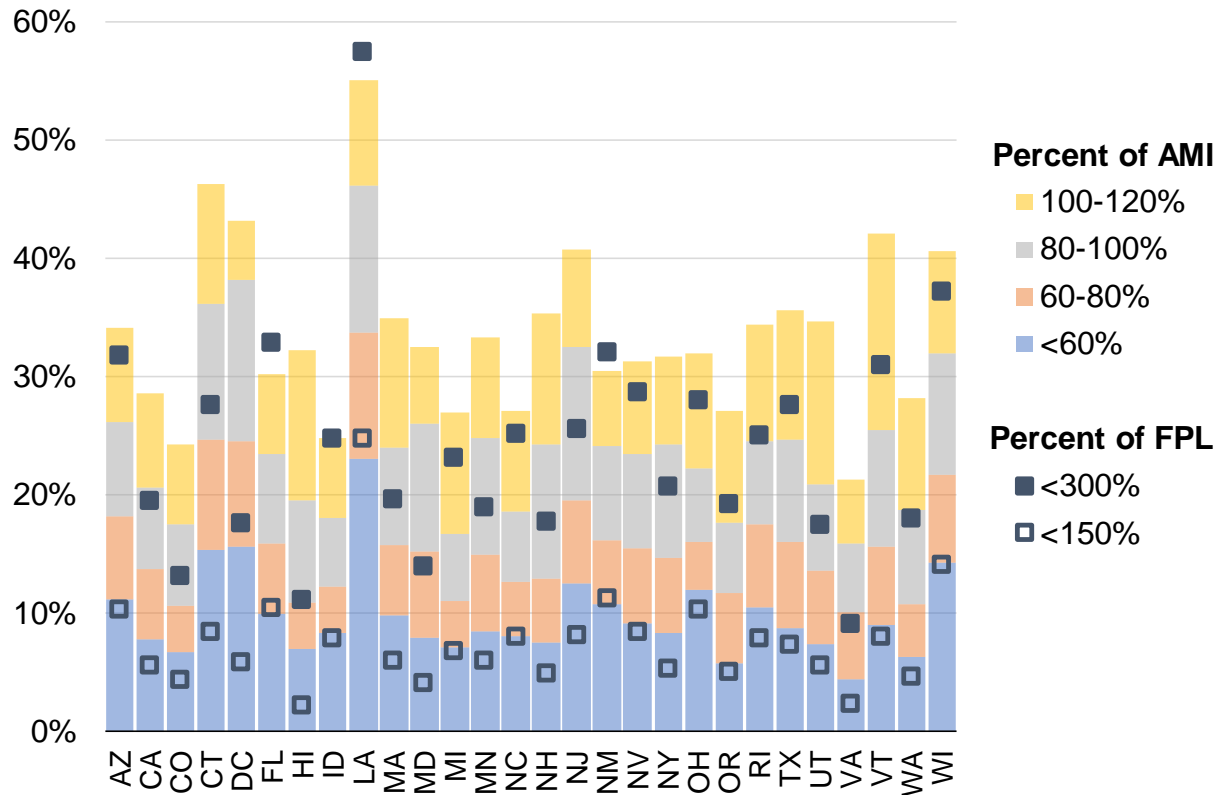


Notes: Income estimates are for the year 2019, irrespective of when the PV installation occurred. See appendix slide 42 for results showing the full income distribution over time in terms of both state percentiles and AMI.

- LMI shares are rising slowly over time, consistent with earlier trends based on absolute income levels
- Growth has been somewhat greater for higher LMI thresholds (<120% AMI and <300% FPL)
 - ▣ Percent of solar adopters with incomes <300% of FPL rose from 16-21% over the 2010-2018 period, while the percent <150% of FPL rose from just 5-6%
- Since 2016, LMI shares based on AMI have remained relatively flat, while shares based on FPL have continued to rise
 - ▣ May reflect differentially higher growth in solar adoption in lower-income areas

LMI Sample Shares by State

Percent of 2018 Solar Adopters



Notes: The figure excludes states for which the dataset contains fewer than 100 systems or less than 10% market coverage in 2018 (see appendix slide 35 for sample size and market coverage by state). Comparison populations for each metric are based on all HHs, regardless of home-ownership. The values shown for FPL are based on the 2018 FPL for a family of three (\$20,780 for the 48-contiguous states; \$23,900 for Hawaii).

- LMI shares vary across states, mirroring the earlier trends based on both absolute and relative income levels
 - ▣ Typically 5-10% of solar adopters are <150% of FPL, while 15-30% are <300% of FPL
 - ▣ Typically 10-25% of solar adopters are <80% of AMI, while 25-40% are <120% of AMI
- States with high LMI shares are generally the same as those noted earlier when comparing to state median incomes
 - ▣ DC is an exception, as its AMI is based on a larger area that includes relatively wealthy surrounding suburbs

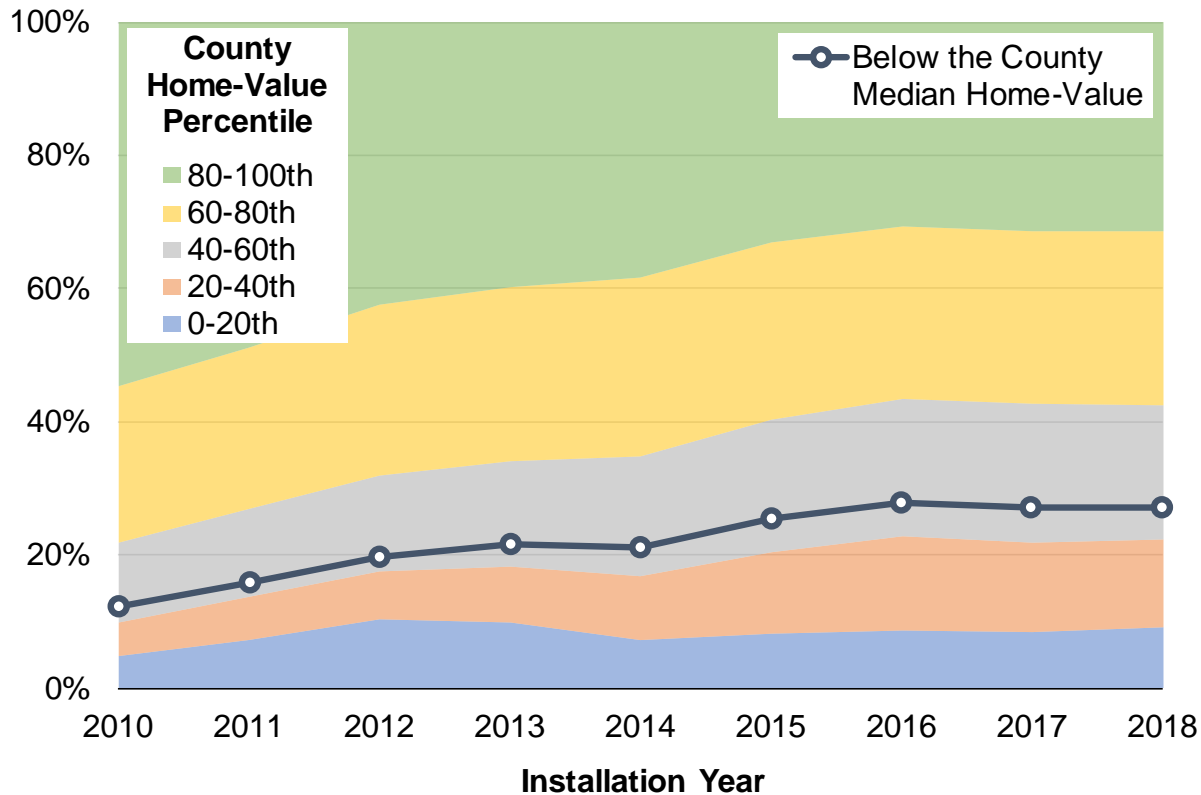
County-level statistics on LMI shares are accessible through the online data visualization tool

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Solar-Adopter Home Values by County Percentile over Time

Percent of Solar Adopters

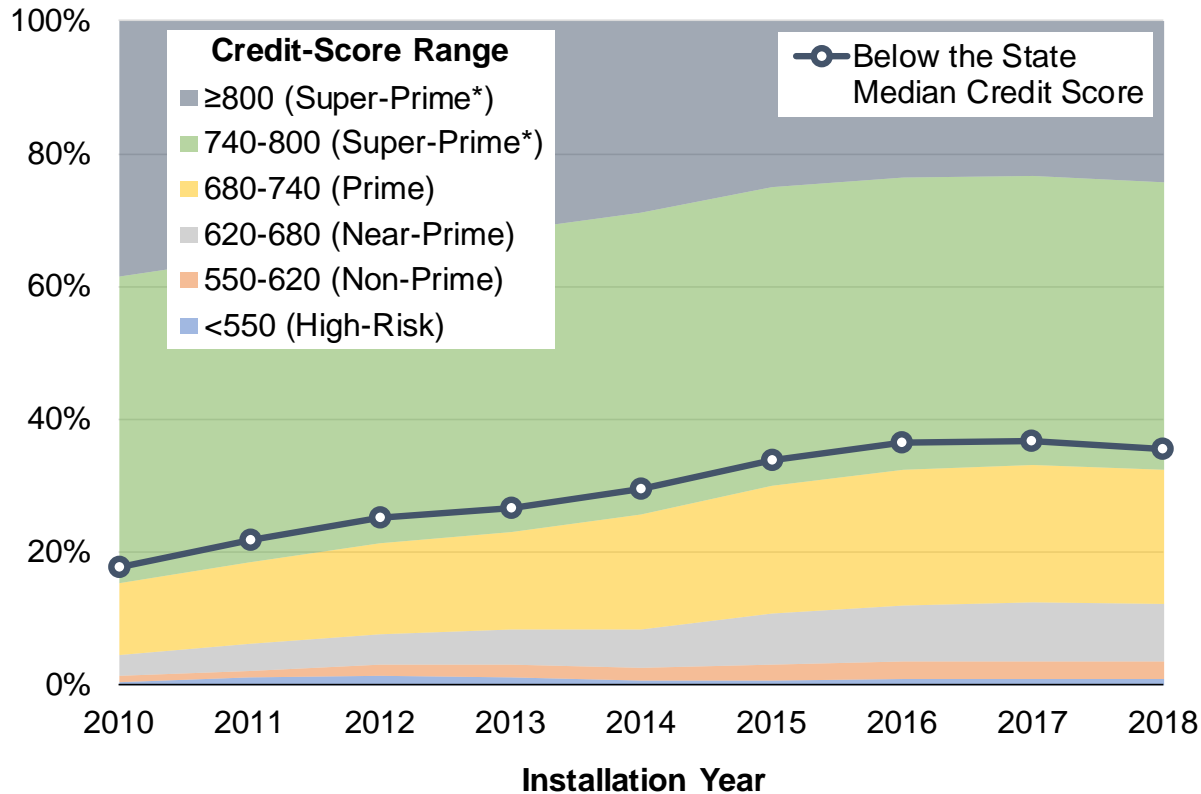


Notes: Home values and county-level percentiles are based on Experian estimates; see appendix slide 38 for further details.

- Comparing estimated home values between solar adopters and other HHs in the same county reveals similar trends as the earlier income-based comparisons:
 - ▣ In general solar adoption has been shifting toward lower home-value HHs over time
 - ▣ Home values for solar adopters in 2018 skew high relative to other HHs in the same county (27% are below their county median home value)
 - ▣ This skew generally applies across states (see appendix slide 43), though there is some variation, and a number of states exhibit rough parity between solar adopters and other HHs
- General similarities in home-value and income trends reflect their correlation (see appendix slide 44)

Solar-Adopter Credit Scores over Time

Percent of Solar Adopters



Notes: The figure is based on Experian Scorex PLUS data, which is similar to a traditional FICO score. The top two groups in the figure are both classified by Experian as “Super-Prime”, but are split into two to provide greater resolution. Due to data privacy issues, data provided for each solar adopter are based on the median value for the associated Census block (typically 10-20 households), rather than on the specific household.

- Credit scores are often a key determinant to a HH’s ability to obtain solar financing
- The share of adopters with lower credit scores has grown over time, based on block-level medians (see figure notes)
- That said, solar adopters generally have high credit scores
 - ▣ Almost 90% of 2018 solar adopters have either Prime or Super-Prime credit scores
 - ▣ This distribution can vary across states (see appendix slide 43); Louisiana has a particularly large share of low credit-score solar adopters
- Compared to the broader population, solar adopters credit scores skew high
 - ▣ Among 2018 solar adopters, 35% had credit scores below their respective state median

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Conclusions

- ❑ Solar adopters span all income ranges, and include LMI households in all states
- ❑ Solar-adopter incomes skew high relative to the broader population, though less so when compared to just owner-occupied households, and less so when compared on a more localized basis
- ❑ Solar adopters also skew high in terms of other financial measures—namely, home value and credit score
- ❑ Income and other disparities between solar adopters and the broader population have been diminishing gradually over time, reflecting both a broadening and a deepening of U.S. solar markets
- ❑ The degree of disparity varies significantly across states and local markets, and some markets exhibit income parity between solar adopters and the broader population



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Appendix



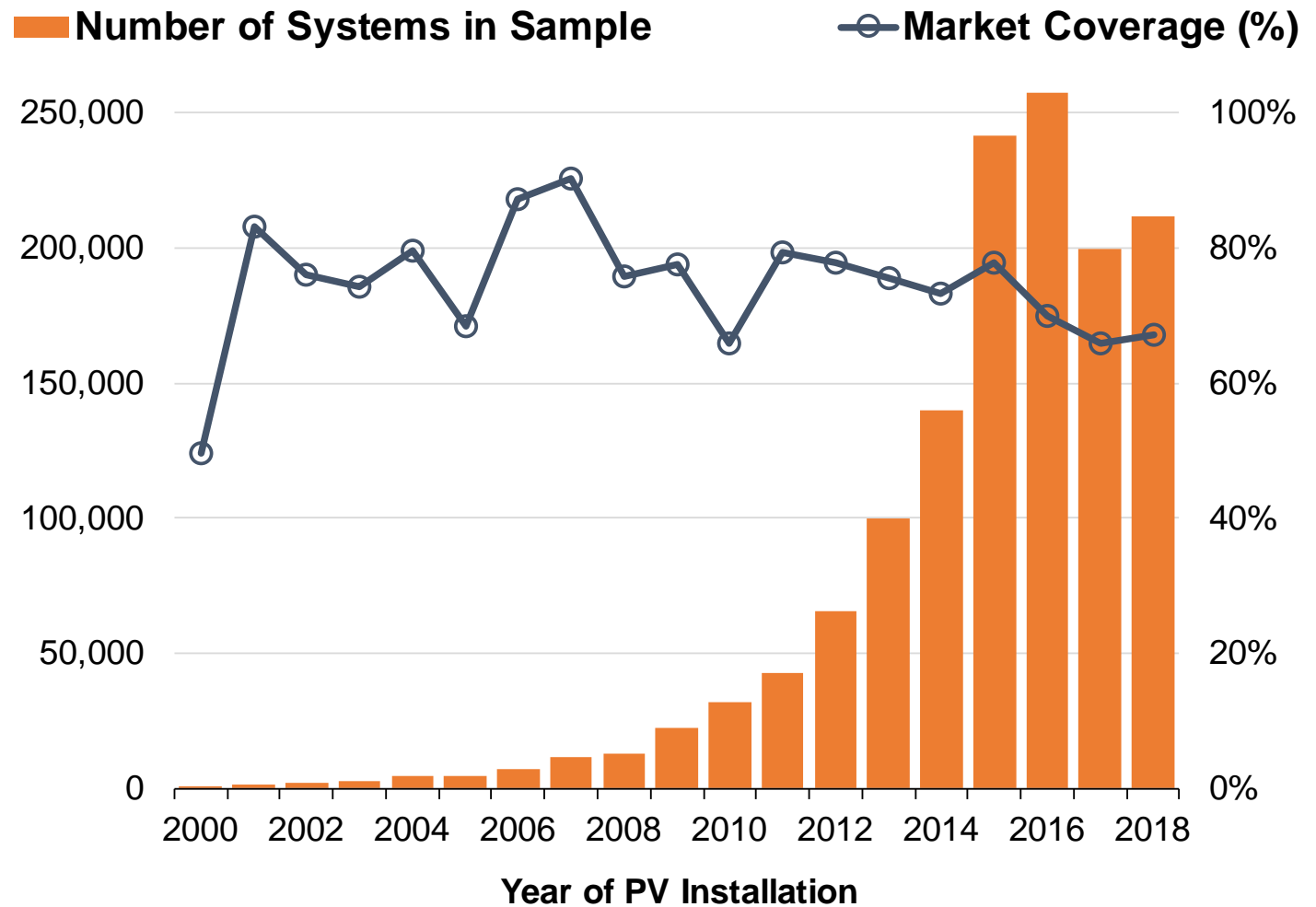
Details on Sample Construction

Sample Frame Stage	Tracking the Sun (TTS)	BuildZoom (BZ)	Total
(1) Total PV addresses	1,235,661	1,009,151	2,244,812
(2) Unique addresses	1,235,661	589,122	1,824,783
(3) Matched to incomes	1,234,617	554,637	1,789,254
(4) Sample frame for income analysis	1,176,979	189,276	1,366,255

- (1) TTS total represents the subset of all systems in the TTS dataset with valid addresses. BZ total represents the sum total of all PV permit applications provided by BZ to Berkeley Lab in March 2019.
- (2) Both the TTS and BZ addresses were sent to Melissa Data to standardize the address fields to known U.S. Postal Service addresses and to append MAK codes and building type. The cleaned addresses and MAK codes for BZ systems were then matched against those for TTS, and duplicates within the BZ dataset were removed.
- (3) The values shown are the number of records for which Experian was able to append income estimates.
- (4) A multitude of additional screens were then applied to define the ultimate sample frame for the income analysis. This includes dropping all:
 - Non-residential systems, based on, for TTS systems, either the customer segment or system size in the TTS dataset and, for BZ systems, the building type appended by Melissa Data
 - Addresses for which the precision of the lat/long coordinates returned by the Google API was insufficient to reliably identify the Census block group
 - BZ permits lacking an inspection date or with permit status types that indicate a reasonable likelihood the system is incomplete
 - BZ permits with permit description fields containing key words (e.g., pool, heat) or with permit subtypes that indicate the application is likely a solar domestic hot water or pool heating system, rather than PV
 - BZ permits from FL, HI, and MO with permit description fields lacking any key words (e.g., photovoltaic, watts) that would otherwise confirm that the application is solar PV; these states required a more-stringent standard due to the large proportion of non-PV systems included in the initial BZ dataset

Annual Sample Sizes for Income Analysis

Install Year	Number of Systems	Market Coverage
2000	367	50%
2001	1,455	83%
2002	2,417	76%
2003	3,037	74%
2004	4,765	80%
2005	4,559	69%
2006	7,369	87%
2007	11,868	90%
2008	12,899	76%
2009	22,800	78%
2010	31,865	66%
2011	42,731	79%
2012	65,454	78%
2013	100,108	75%
2014	140,098	73%
2015	241,809	78%
2016	257,406	70%
2017	199,367	66%
2018	211,407	67%



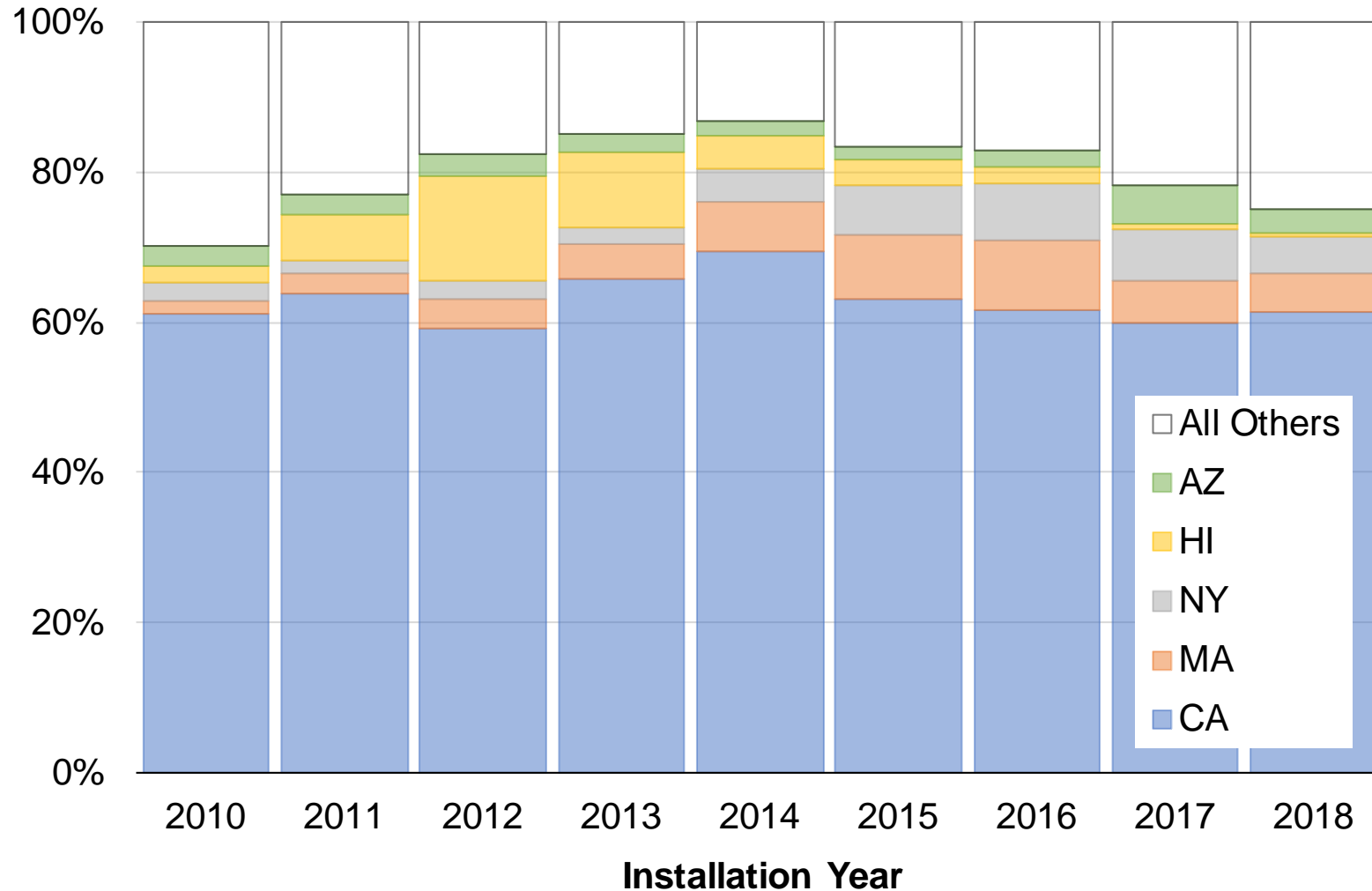
State Sample Sizes for Income Analysis

State	All Years				2018 Installations			
	TTS	BZ	Total	Market Coverage	TTS	BZ	Total	Market Coverage
AK	0	2	2	0%	0	0	0	0%
AL	1	2	3	1%	0	0	0	0%
AR	81	11	92	7%	0	5	5	1%
AZ	0	36,371	36,371	26%	0	7,012	7,012	32%
CA	856,723	7,096	863,819	95%	128,380	1,271	129,651	93%
CO	0	19,700	19,700	39%	0	3,175	3,175	36%
CT	27,916	747	28,663	83%	4,674	280	4,954	86%
DC	3,937	243	4,180	97%	689	99	788	73%
DE	0	164	164	2%	0	98	98	10%
FL	2,637	8,939	11,576	35%	531	3,147	3,678	32%
GA	0	53	53	5%	0	8	8	21%
HI	0	46,291	46,291	60%	0	718	718	18%
IA	0	94	94	3%	0	38	38	5%
ID	0	2,012	2,012	53%	0	1,097	1,097	61%
IL	358	161	519	14%	0	51	51	3%
IN	1	64	65	3%	0	25	25	5%
KS	0	101	101	7%	0	29	29	6%
KY	0	5	5	0%	0	1	1	1%
LA	0	11,407	11,407	45%	0	468	468	23%
MA	84,910	1,827	86,737	100%	10,306	680	10,986	94%
MD	0	11,634	11,634	18%	0	1,546	1,546	20%
ME	0	0	0	0%	0	0	0	0%
MI	1	727	728	16%	0	281	281	16%
MN	1,096	1,651	2,747	66%	128	690	818	81%
MO	0	310	310	4%	0	42	42	3%
MS	0	0	0	0%	0	0	0	0%
MT	0	291	291	13%	0	63	63	23%

State	All Years				2018 Installations			
	TTS	BZ	Total	Market Coverage	TTS	BZ	Total	Market Coverage
MS	0	0	0	0%	0	0	0	0%
MT	0	291	291	13%	0	63	63	23%
NC	8,375	199	8,574	80%	2,382	58	2,440	81%
ND	0	5	5	15%	0	4	4	67%
NE	0	74	74	15%	0	23	23	14%
NH	5,870	4	5,874	77%	1,143	3	1,146	100%
NJ	8,326	1,600	9,926	10%	1,637	70	1,707	10%
NM	17,036	481	17,517	86%	2,787	221	3,008	78%
NV	31,581	4,554	36,135	100%	8,780	1,128	9,908	100%
NY	70,951	2,172	73,123	68%	10,032	340	10,372	61%
OH	2,100	260	2,360	50%	53	122	175	13%
OK	0	14	14	2%	0	7	7	3%
OR	16,539	868	17,407	100%	1,662	239	1,901	85%
PA	6,129	977	7,106	32%	0	155	155	4%
RI	5,424	0	5,424	100%	1,628	0	1,628	100%
SC	1	2,034	2,035	11%	0	523	523	8%
SD	0	1	1	2%	0	0	0	0%
TN	0	157	157	11%	0	30	30	25%
TX	1,341	17,040	18,381	35%	51	3,552	3,603	27%
UT	6,198	3,069	9,267	26%	1,249	259	1,508	24%
VA	0	961	961	14%	0	295	295	13%
VT	10,880	2	10,882	100%	1,829	0	1,829	100%
WA	6,079	4,798	10,877	55%	4,760	159	4,919	100%
WI	2,487	103	2,590	64%	681	13	694	89%
WV	0	0	0	0%	0	0	0	0%
WY	0	0	0	0%	0	0	0	0%
US	1,176,979	189,276	1,366,255	73%	183,382	28,025	211,407	68%

Sample Composition over Time

Percent of Sample

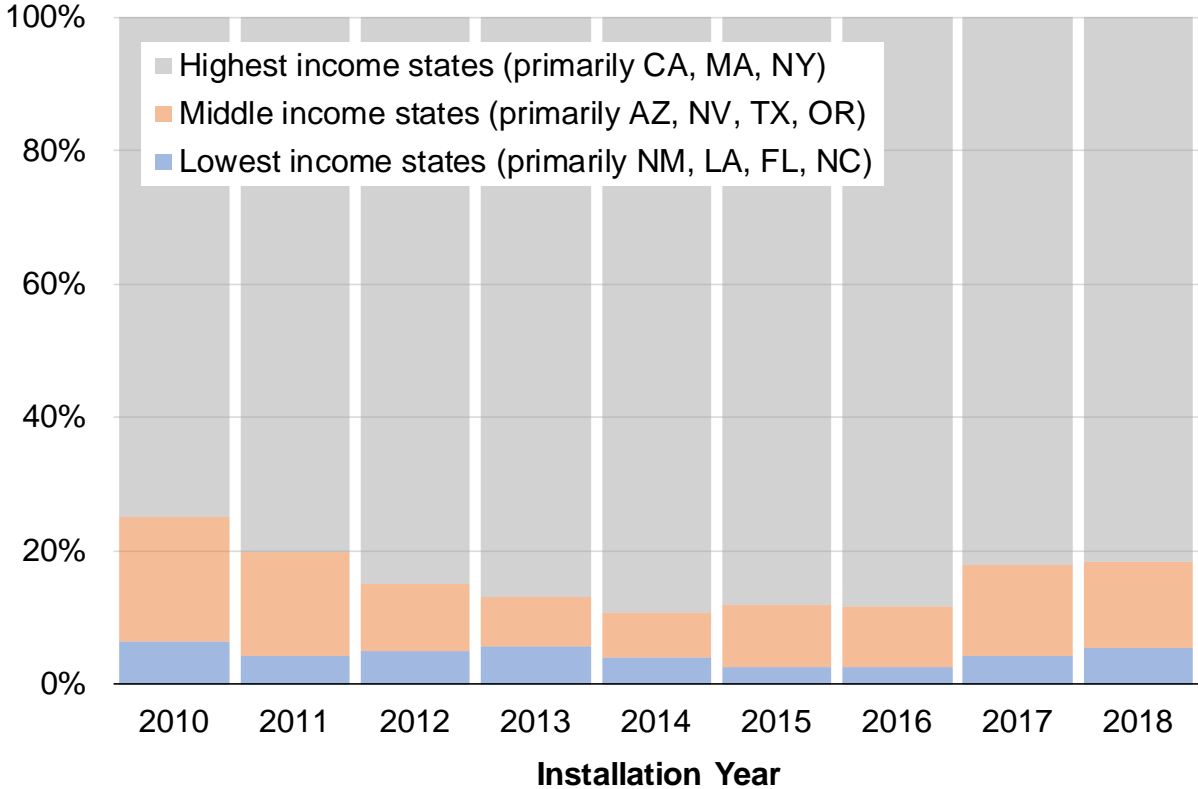


Distribution of Solar Adopters by State Median Incomes

Comparison of Data Sample to Total U.S. Market

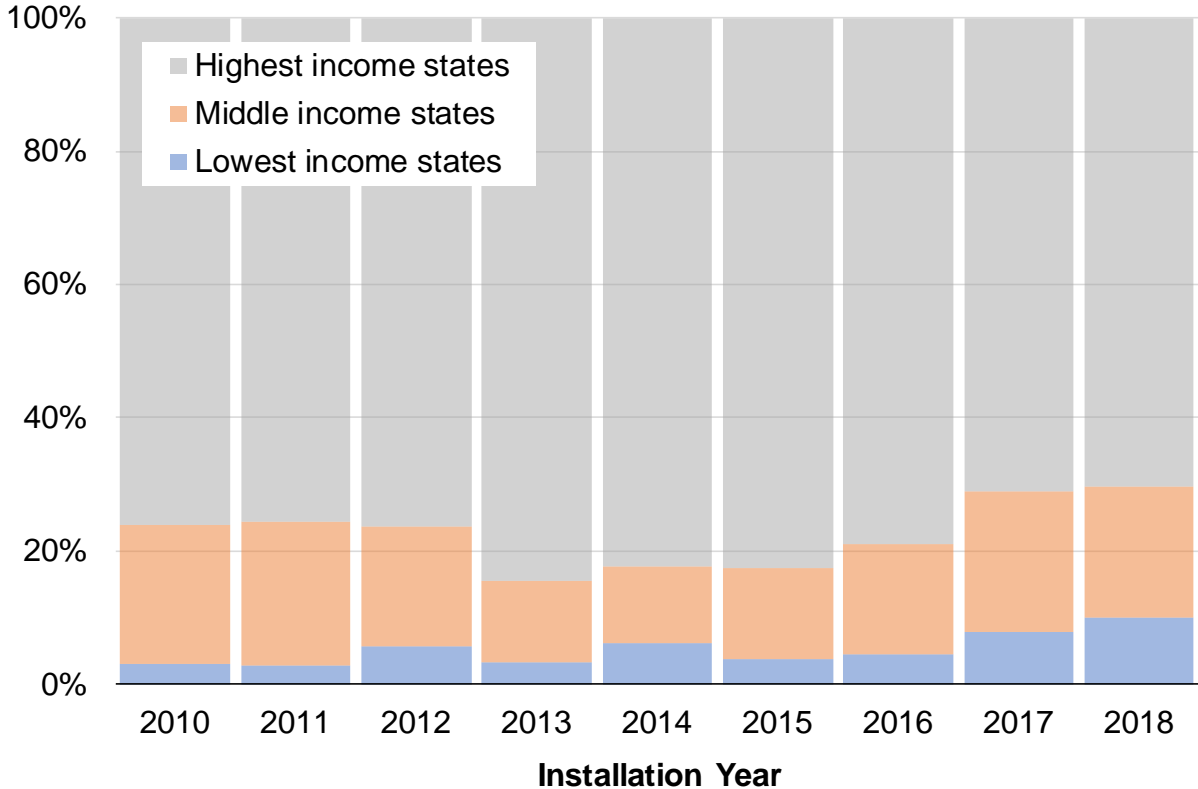
Data Sample

Percent of Solar Adopters



Total U.S. Market

Percent of Solar Adopters



Notes: Highest, Middle, and Lowest income states are those in the upper, middle, and lower thirds, respectively, based on Census data for each state's median income among owner-occupied households. Figure for Total U.S. Market is based on data for state-level residential installations from SEIA and Wood Mackenzie's "Solar Market Insight" report.

Experian Data Fields Used in this Analysis

- **Estimated Household Income:** The total estimated income for a living unit, incorporating several highly predictive individual and household level variables. The income estimation is determined using multiple statistical methodologies to predict the income estimate for the living unit.
- **Estimated Current Home Value:** Predicts the current home value; integrates market-specific data sources that include the most current, complete and relevant home value information available. In addition to public record data, such as deed data, the model considers all available market information including recent sales and property listings.
- **SCOREX PLUS** (credit score): Predicts the likelihood of future serious delinquencies on any type of account. Due to limitations related to the Federal Fair Credit Reporting Act (FCRA), data provided for each address represent the corresponding Census block medians, rather than the credit score of the specific individual or household.

Experian Income Model Accuracy

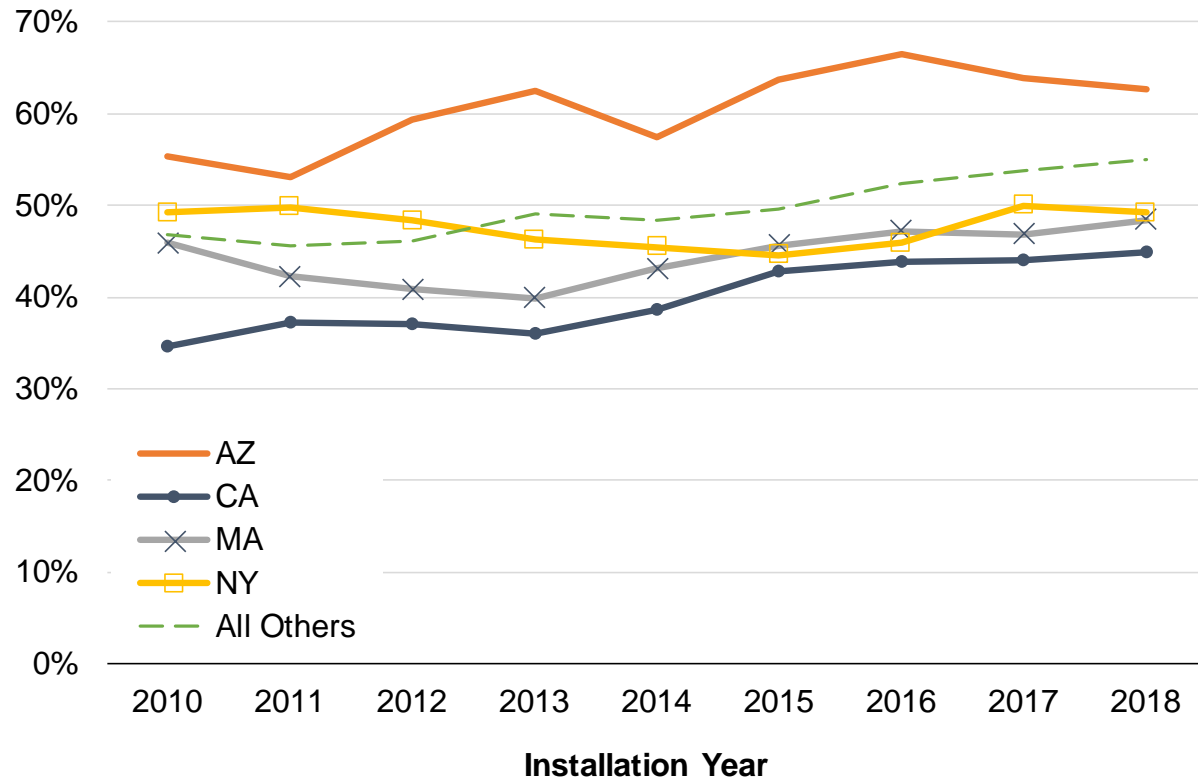
Excerpted from: Experian (2018). *ConsumerView Estimated Household Income V6*. July 2018.

The percentage of households that the model predicts accurately was determined overall and at various income cut points. Multiple statistical tests were performed to assess the overall fit of the model. These tests show with statistical significance that the classification accuracy is better than chance. Based on these tests, the income estimate can confidently be described as predicting the correct income category 129% better than chance. In other words, with the model the efficiency of the income prediction is substantially greater than not having a model and randomly assigning a household to an income category. Below are prediction efficiencies for multiple income levels:

Income Level	Accuracy Rate
Above or below \$15,000	86.8%
Above or below \$25,000	81.1%
Above or below \$35,000	77.9%
Above or below \$50,000	76.0%
Above or below \$75,000	76.5%
Above or below \$100,000	79.9%
Above or below \$150,000	89.3%

Solar-Adopter Income Trends over Time for Select States

Percent of Solar Adopters with Incomes Below \$100k



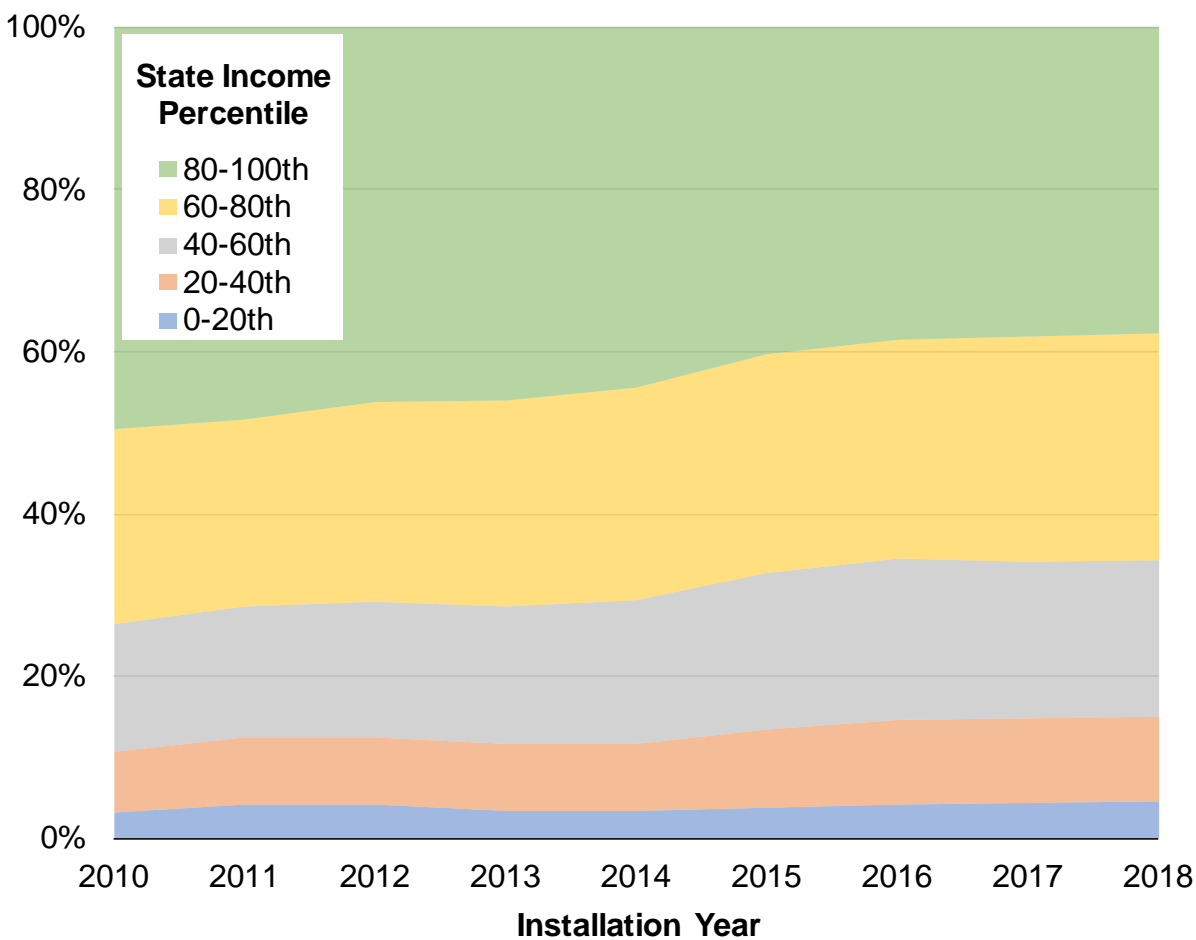
- The overall trend of solar adoption slowly migrating to lower incomes is fairly consistent across state markets
- That said, trends for some of the of the larger state markets are uneven
 - ▣ AZ: year-over-year variability, perhaps due partly to geographic shifts in the market
 - ▣ MA and NY: trends were moving in the opposite direction during the first half of the decade before reversing course
- The same general trends persist if other income thresholds are used instead of \$100k

Additional state-level time series data can be accessed through the online data visualizations

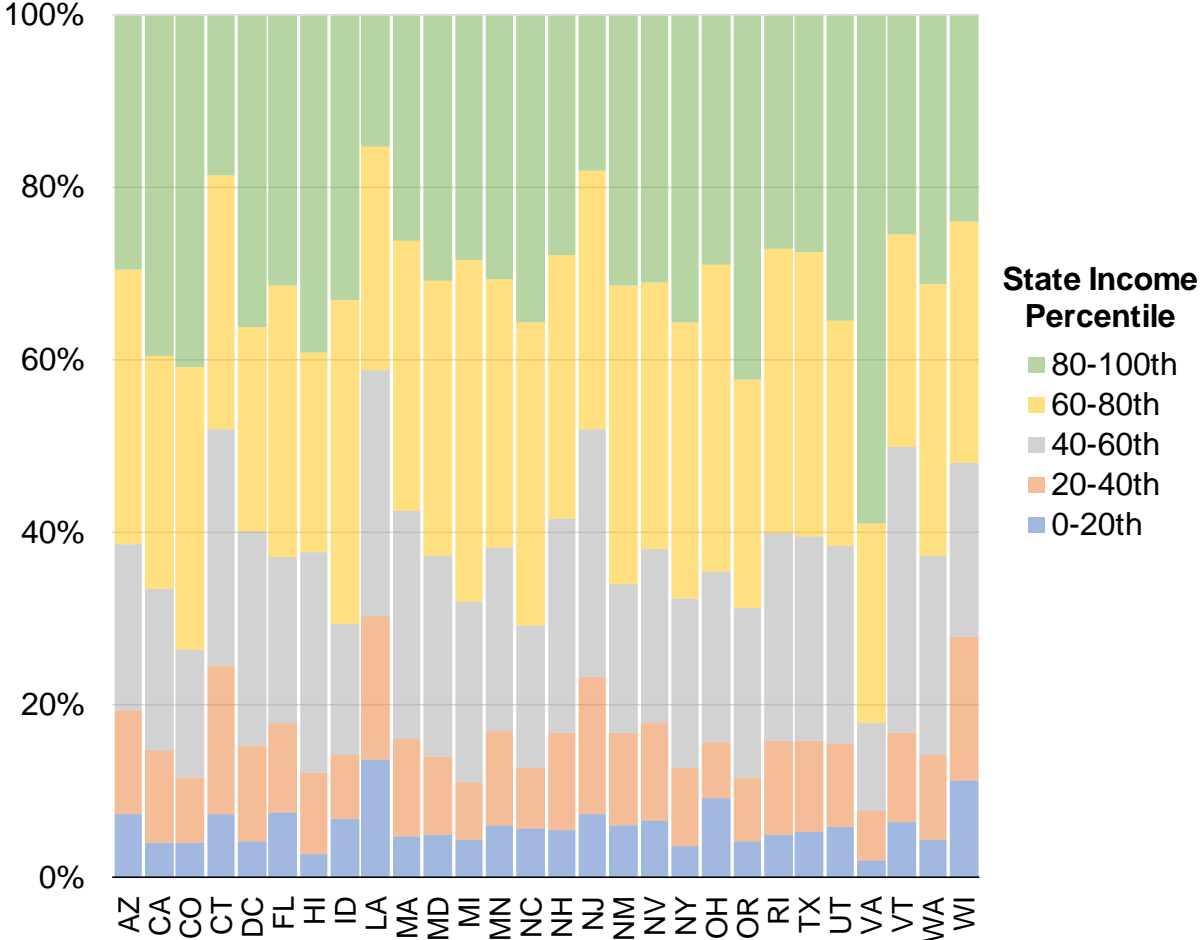
Solar-Adopter Income Distribution by State Quintile

Trends over Time and by State

Percent of Solar Adopters



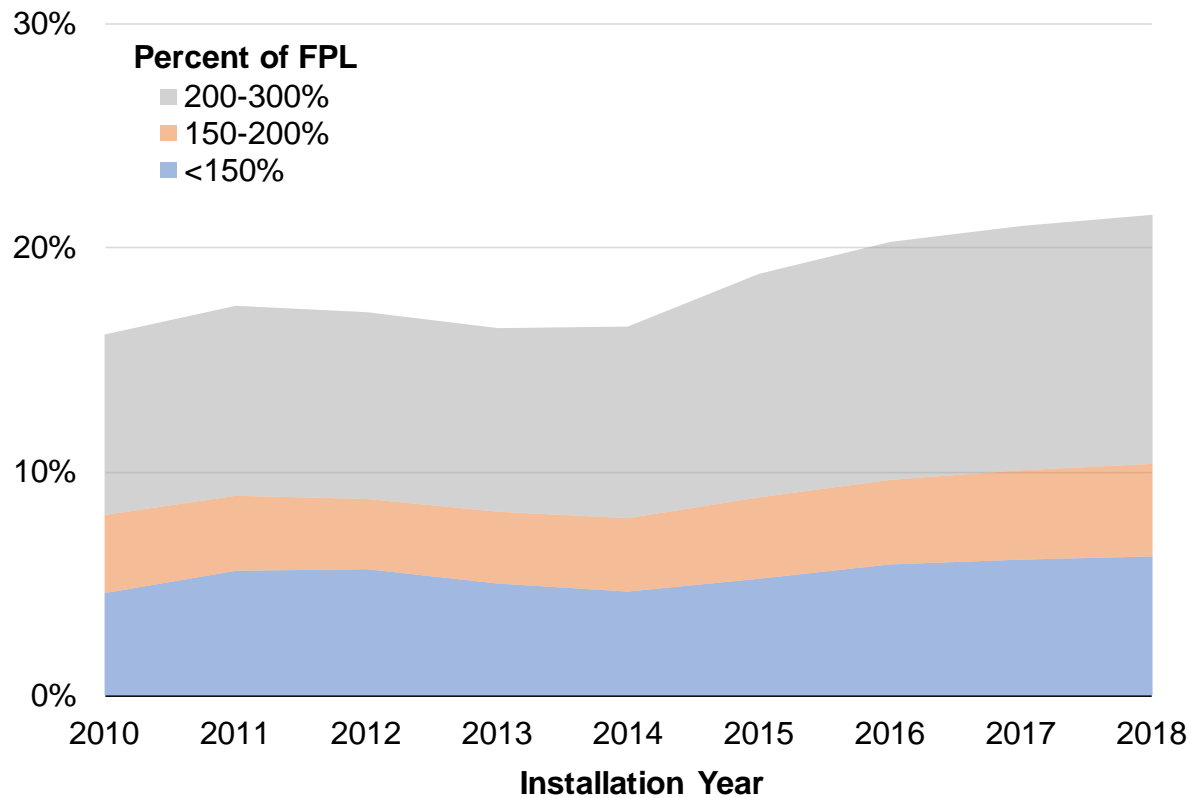
Percent of 2018 Solar Adopters



LMI Sample Shares over Time

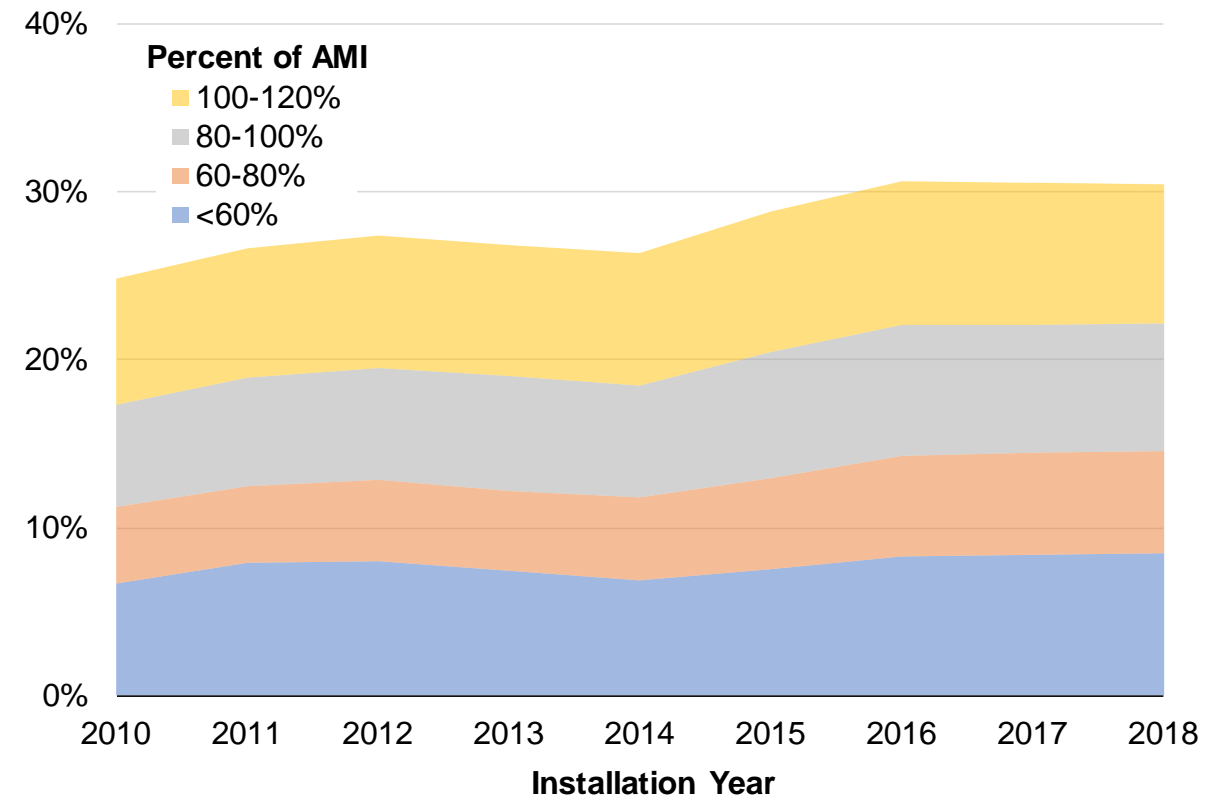
Income as a Percent of FPL

Percent of Solar Adopters



Income as a Percent of AMI

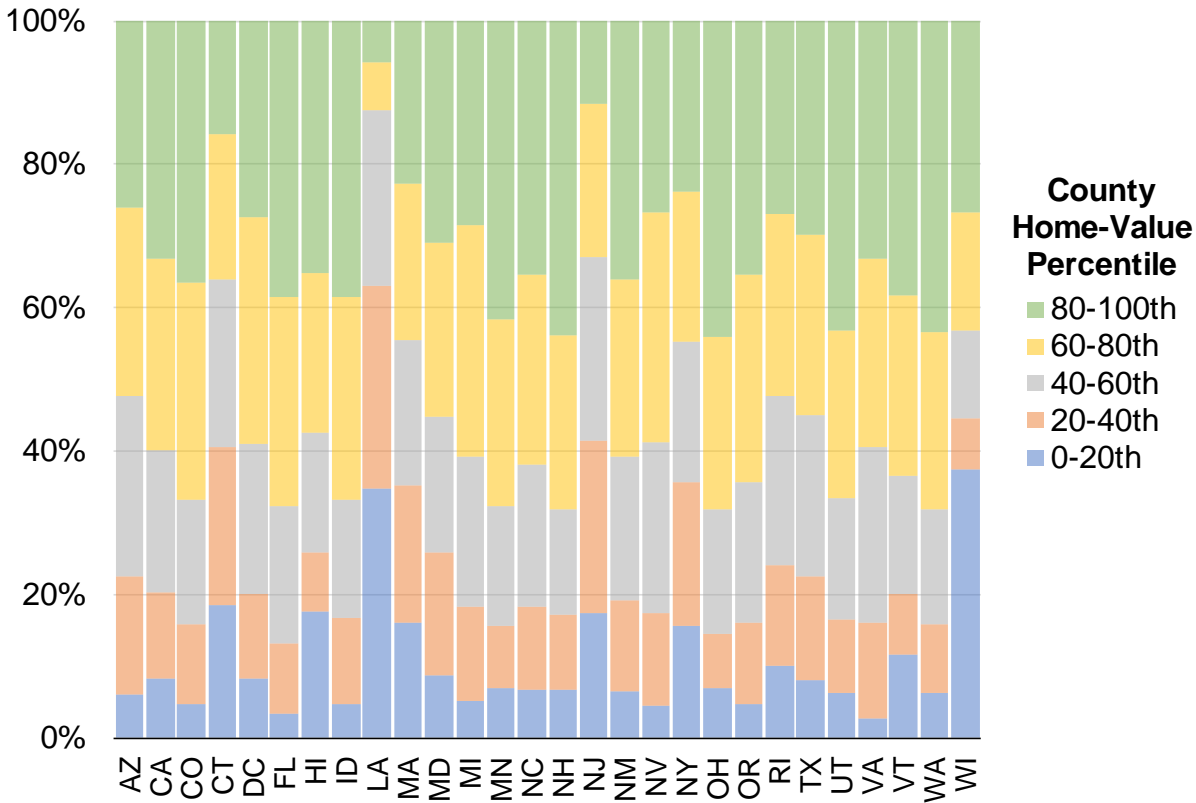
Percent of Solar Adopters



Solar-Adopter Home-Value and Credit-Score Distributions by State

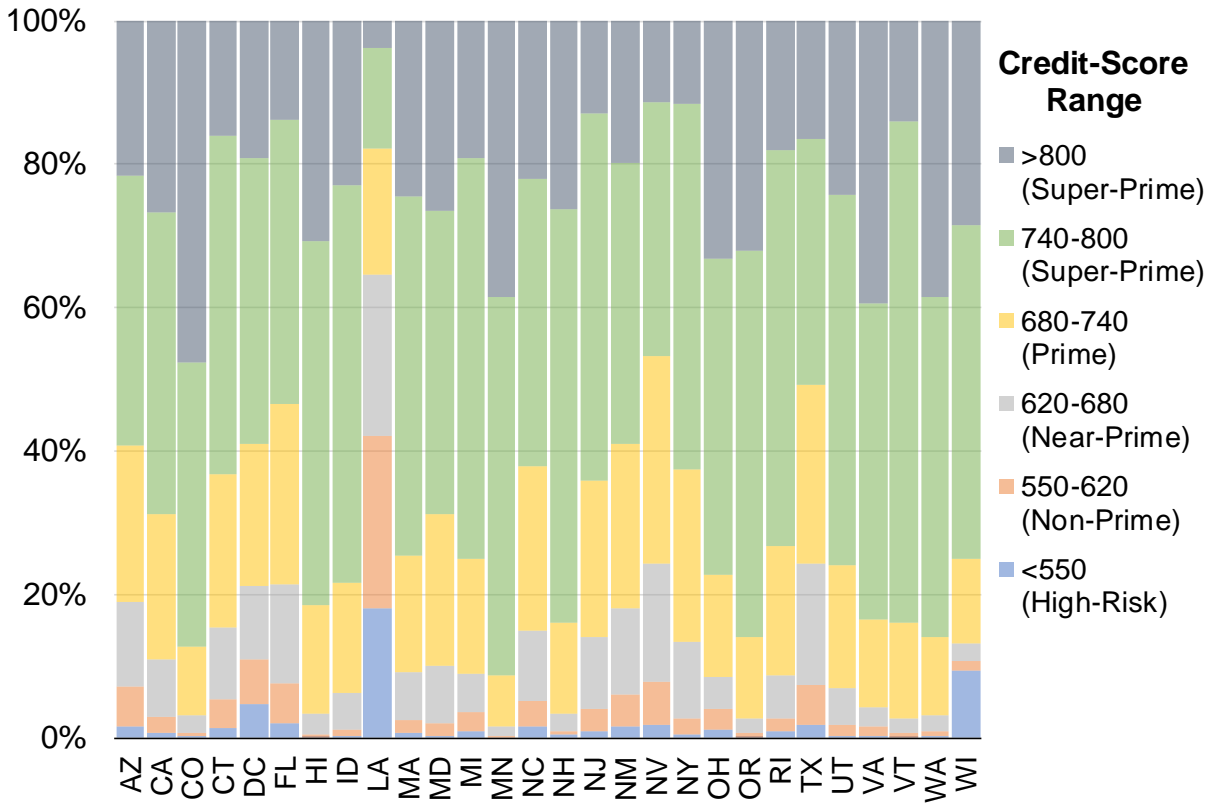
Solar-Adopter Home Values

Percent of 2018 Solar Adopters



Solar-Adopter Credit Scores

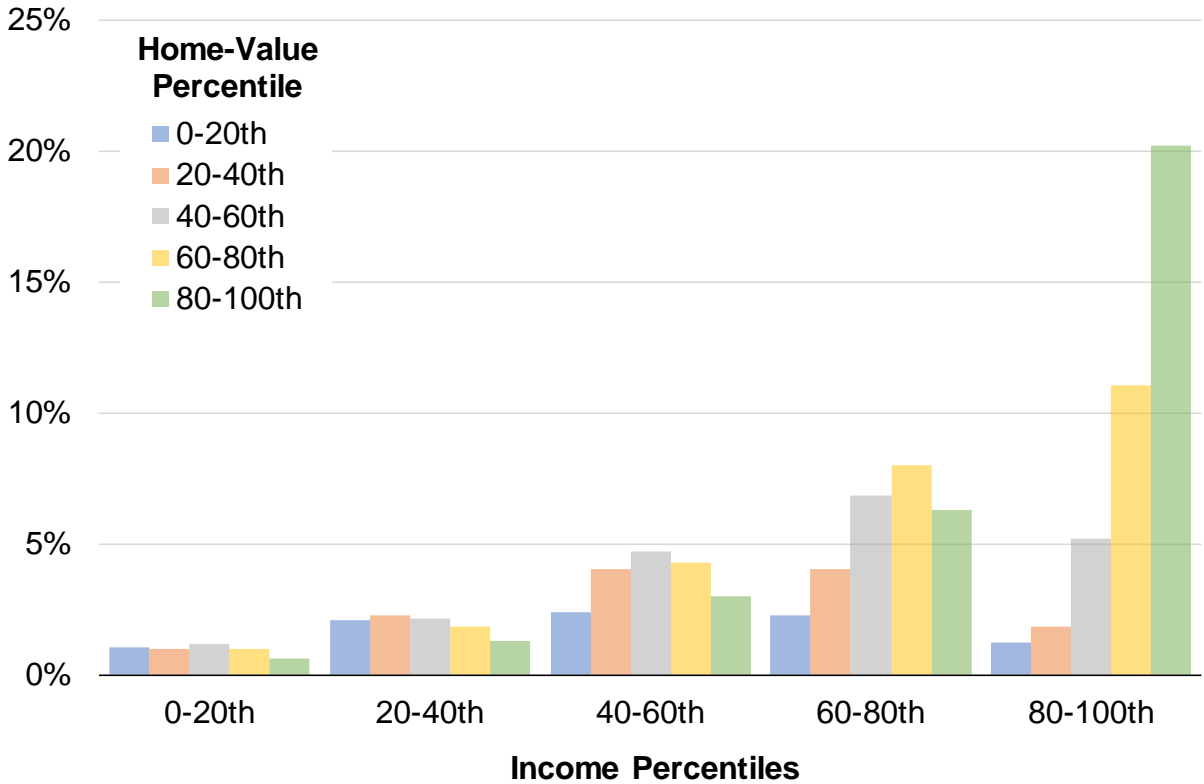
Percent of 2018 Solar Adopters



Comparison of Solar-Adopter Incomes with Home Values and Credit Scores

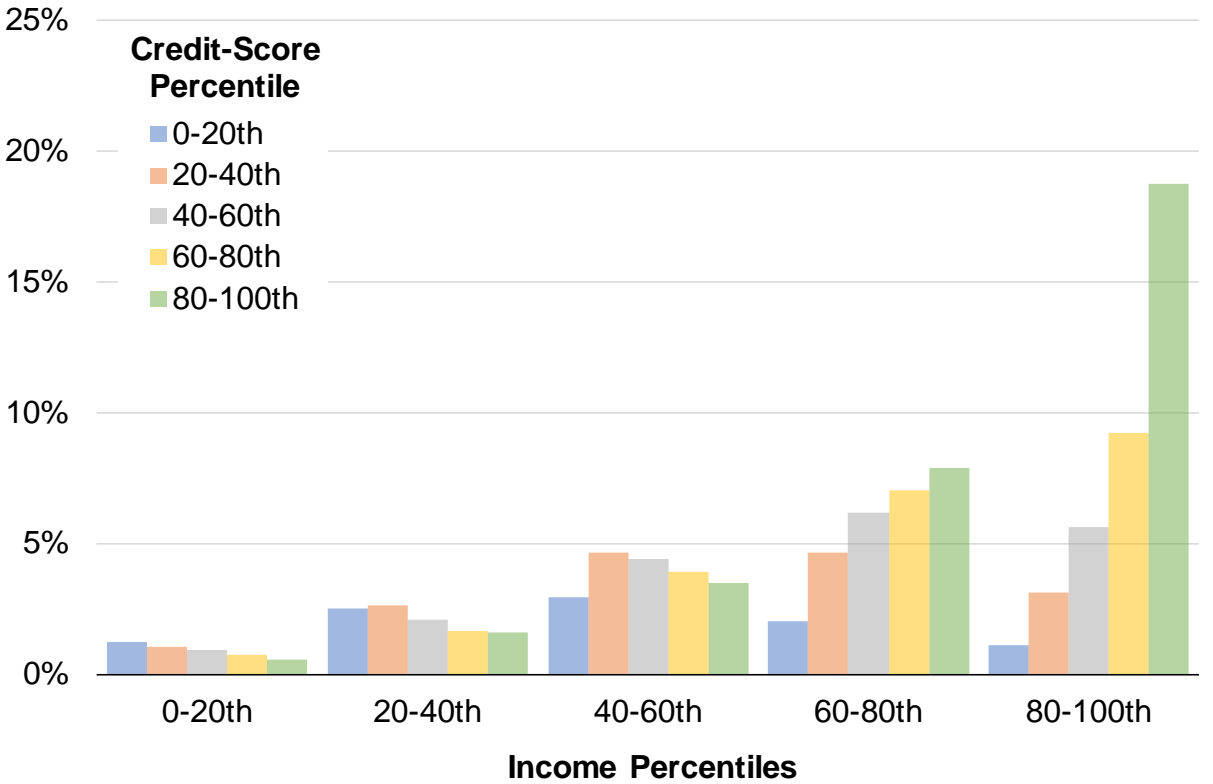
Income vs. Home-Value

Percent of 2018 Solar Adopters



Income vs. Credit-Score

Percent of 2018 Solar Adopters



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