Energy Technologies Area Lawrence Berkeley National Laboratory

Income Trends of Residential PV Adopters

An analysis of household-level income estimates

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Acknowledgments

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We would also like to thank participants in the SETO-funded project, *State Strategies to Bring Solar to Low- and Moderate-Income Communities*, for providing invaluable input and feedback on this work. That project, led by the Clean Energy States Alliance, includes representatives from public agencies across six states: Connecticut Green Bank; District of Columbia Department of Energy and Environment; Minnesota Department of Commerce; New Mexico Energy, Minerals and Natural Resources Department; Oregon Department of Energy; Oregon Energy Trust; and Rhode Island Office of Energy Resources. The work presented here was conducted, in part, to inform the efforts of those agencies in developing and implementing new strategies for expanding access and affordability of solar PV among low- and moderate-income (LMI) residents and communities. Finally, we thank the many public agencies, utilities, and other entities that provided the underlying PV system-level data used for this study.

Outline

- Overview and Background
- Data
- Results
  - Median incomes of PV adopters vs. broader population
  - Income distribution of PV adopters
  - LMI adoption rates
  - LMI adopter characteristics
- Conclusions
- Appendix

Project Overview

Objective: *Describe income trends among U.S. residential solar adopters, highlighting trends related to low- and moderate-income (LMI) households*

Unique features of this analysis

- ***Household-level income estimates*****:** Experian* address-level income estimates allows for more-precise characterization of PV-adopter incomes
- ***Relatively extensive coverage of the U.S. solar market*****:** Based on Berkeley Lab's latest *Tracking the Sun (TTS)* dataset, covering ~82% of the total U.S. market (with street addresses for ~63% of the market)

Scope

- ***Rooftop solar on single-family homes*****:** Underlying data consist primarily of single-family rooftop PV, but later work may extend analysis to multi-family homes and also to community solar subscribers
- ***Systems installed through 2016 in 13 states*****:** Focuses on states in latest TTS dataset with address data available for large fraction of the market; later work may evaluate more-recent adopters and additional states
- ***Basic descriptive trends*****:** Focus here is on establishing basic trends, but later work may examine underlying causal factors more directly, using more-sophisticated statistical methods

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This work seeks to refine and expand upon prior analyses of PV adopter income trends

- Prior analyses have examined PV-adopter income and other demographic trends:
  - Kevala, Center for American Progress, GTM and PowerScout, UC Energy Institute, CT Green Bank, Energy+Environmental Economics, SolarPulse, NREL, others
- Though their data and methods vary, these prior studies generally:
  - Focus on somewhat limited geographies (single states or several larger state markets)
  - Rely on median incomes at the block-group or zip-code level as proxies for individual PV-adopter incomes (or, in limited cases, survey data from a sample of households)
  - Are somewhat dated
- These studies have yielded mixed results and messages:
  - Some show that PV adopters tend to be more affluent and educated than non-adopters, while perhaps highlighting an attenuation of this trend over time
  - Others emphasize that middle-class adopters are most common and that their numbers have risen over time
  - Varying conclusions about the role of TPO in driving LMI adoption

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Analysis builds off *Tracking the Sun (TTS)*

- TTS 10 dataset (August 2017 release)
  - System-level PV data through 2016
  - ~1.1 million residential systems in total
  - >800,000 systems with street addresses
- This analysis focuses on the 13 states with relatively complete address-level coverage (listed in table to the right)
  - Sample represents 89% of all residential systems in the 13 states covered, and 61% of all U.S. residential systems installed cumulatively through 2016
  - Missing from the analysis are a number of relatively large state residential markets: AZ, CO, HI, MD, NJ

See appendix for additional details on data sources and sample sizes by installation year

State	Analysis Sample Residential systems in TTS dataset with addresses and matched to Experian data	Market Coverage Percent of all state residential systems through 2016 in analysis sample
CA	595,847	92%
CT	18,989	82%
DC	2,573	94%
MA	61,422	95%
MN	597	26%
NC	4,697	93%
NM	10,591	87%
NV	20,150	85%
NY	47,343	64%
OH	1,765	66%
OR	11,684	94%
RI	1,936	97%
VT	3,559	59%
Total	781,153	89%

Notes: *Market Size is based on maximum value reported across three sources: EIA Form 861 data, GTM Solar Market Insight, and TTS 10.* ***MN:*** *Analysis sample consists solely of projects installed through the Made in Minnesota program, representing roughly 50% of statewide installations over the 2014-2016 period.* ***VT:*** *Analysis sample consists primarily of installations through 2015; much of the gap in market coverage is thus associated with 2016 installations.*

Experian household income estimates

Used to characterize income of PV households

- All PV addresses geocoded and sent to Experian for matching
  - Person- or household-level match for 77% of PV addresses
  - Zip+4 match for 23% (zip+4 is one side of one block of a street—typically ~5-10 households)*
  - <1% not matched
- Experian household income estimates
  - Estimated using individual, household and neighborhood level data via an algorithm designed to predict multiple income levels
  - Validation steps include numerous data comparisons and iterations to increase predictive accuracy and outcome
  - Estimates are fit to census income distribution nationally and at a small geographic level (Census Block Group)

**We conducted robustness checks and found no material or consistent difference in PV-adopter income trends when excluding addresses for which income was matched based on zip+4, rather than an exact household-match*

Census data

Used to characterize income of broader population

- American Community Survey (ACS) 2016 5-year averages
  - Downloaded from factfinder.census.gov
- Analysis makes use of variables relating to household median income, household income distributions, and owner occupied / renter status
  - Depending on the element of our analysis, we use Census data published at the level of the block group (BG), county, Metropolitan/Micropolitan Statistical Area (MSA), or state
  - Variables associated with each PV system by first matching the system address to a census block, which then determines its BG, county, and MSA
- PV adopters classified as LMI based on income relative to Area Median Income (AMI)
  - AMI is calculated from Census data, based on MSA median household income (for urban addresses) or county median household income (for rural addresses)
- Experian income data is fit to Census data, implicitly allowing comparability

A note on defining the "reference" population

- Throughout the analysis, PV adopters are compared or characterized relative to some "reference" population
- These reference populations can vary according to their geographical scope
  - Our analysis uses reference populations based on MSAs, states, and the collection of all states
- Reference populations can also be defined in terms of sub-populations within a given geographical area
  - We consider reference populations based on: (a) *all households* (HH) as well as (b) just *owner-occupied households* (OO-HH)
  - Ideally, we would also use reference populations based on just *owner-occupied, single-family households* (as most PV adopters fall within this group), but Census data do not provide income segmented by single vs. multi-family

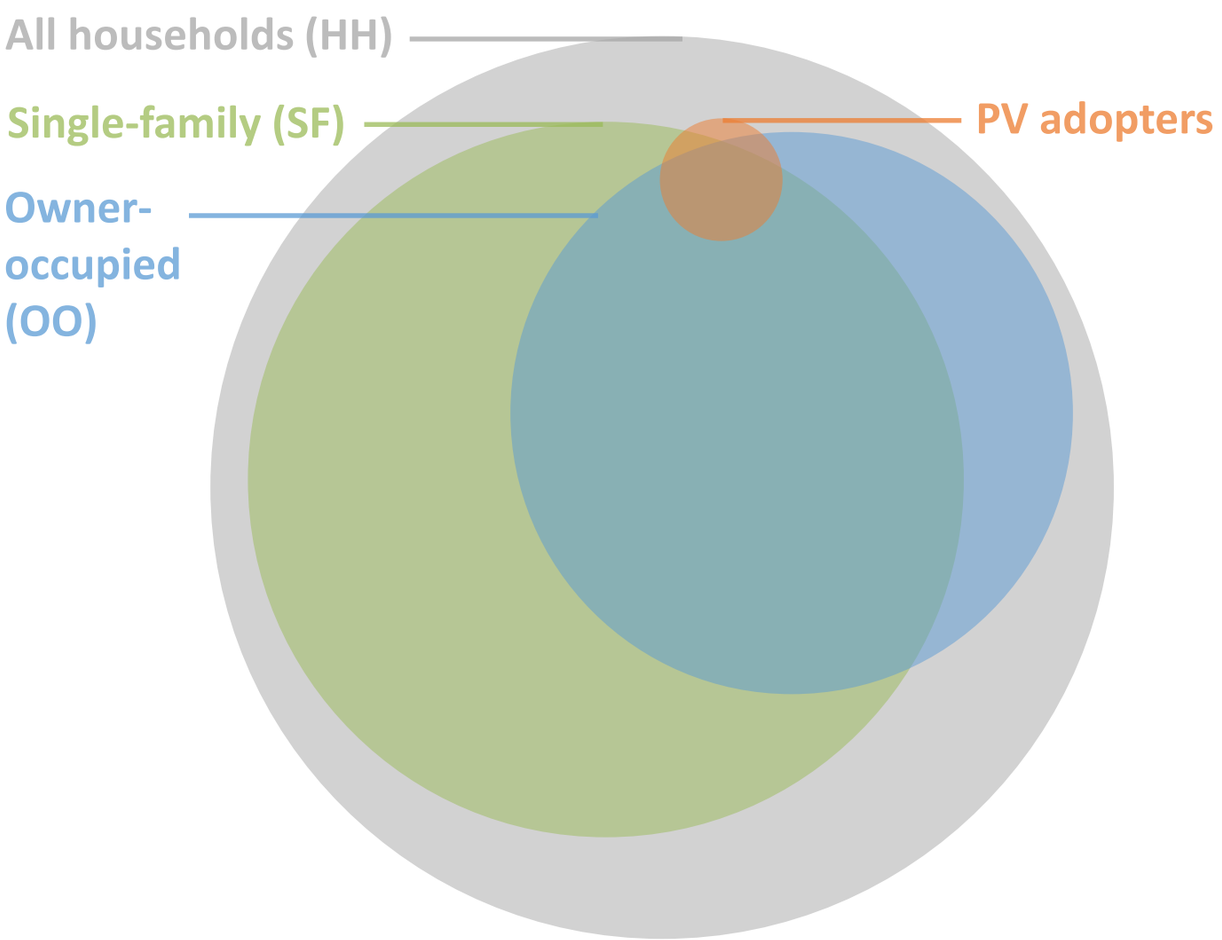

Diagram not drawn to scale

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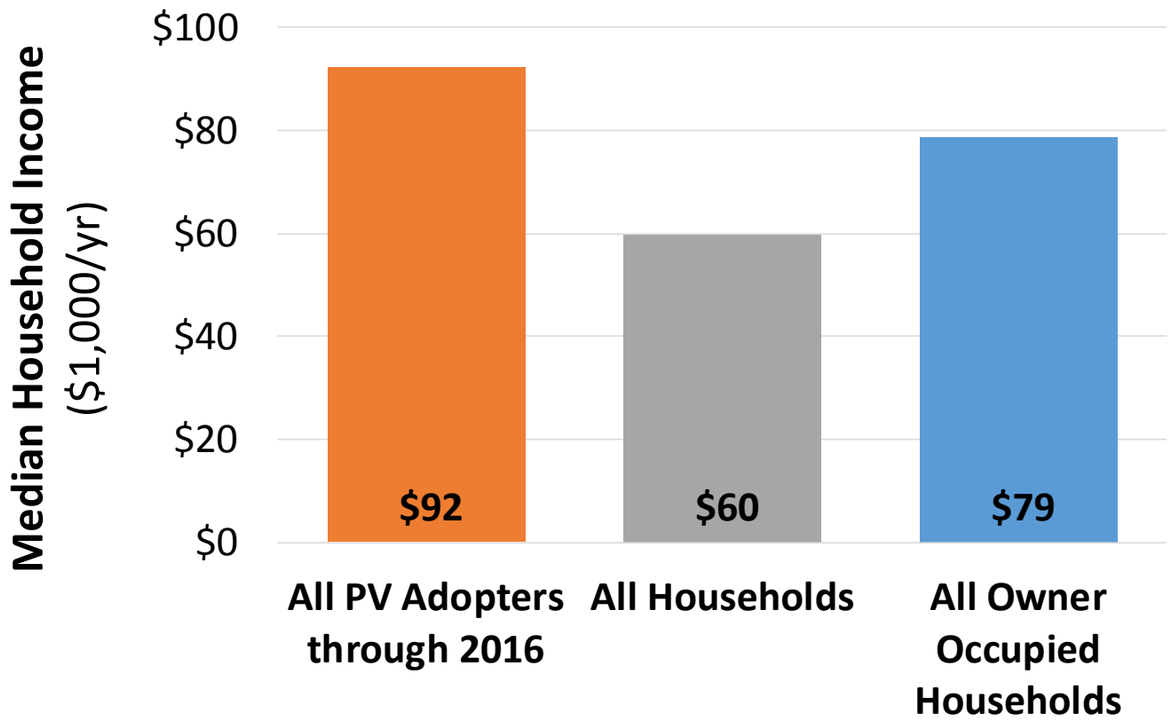
The median income of all PV adopters is notably higher than other HHs, but difference is much smaller when compared to just OO-HHs

Median Incomes (across all states in sample)

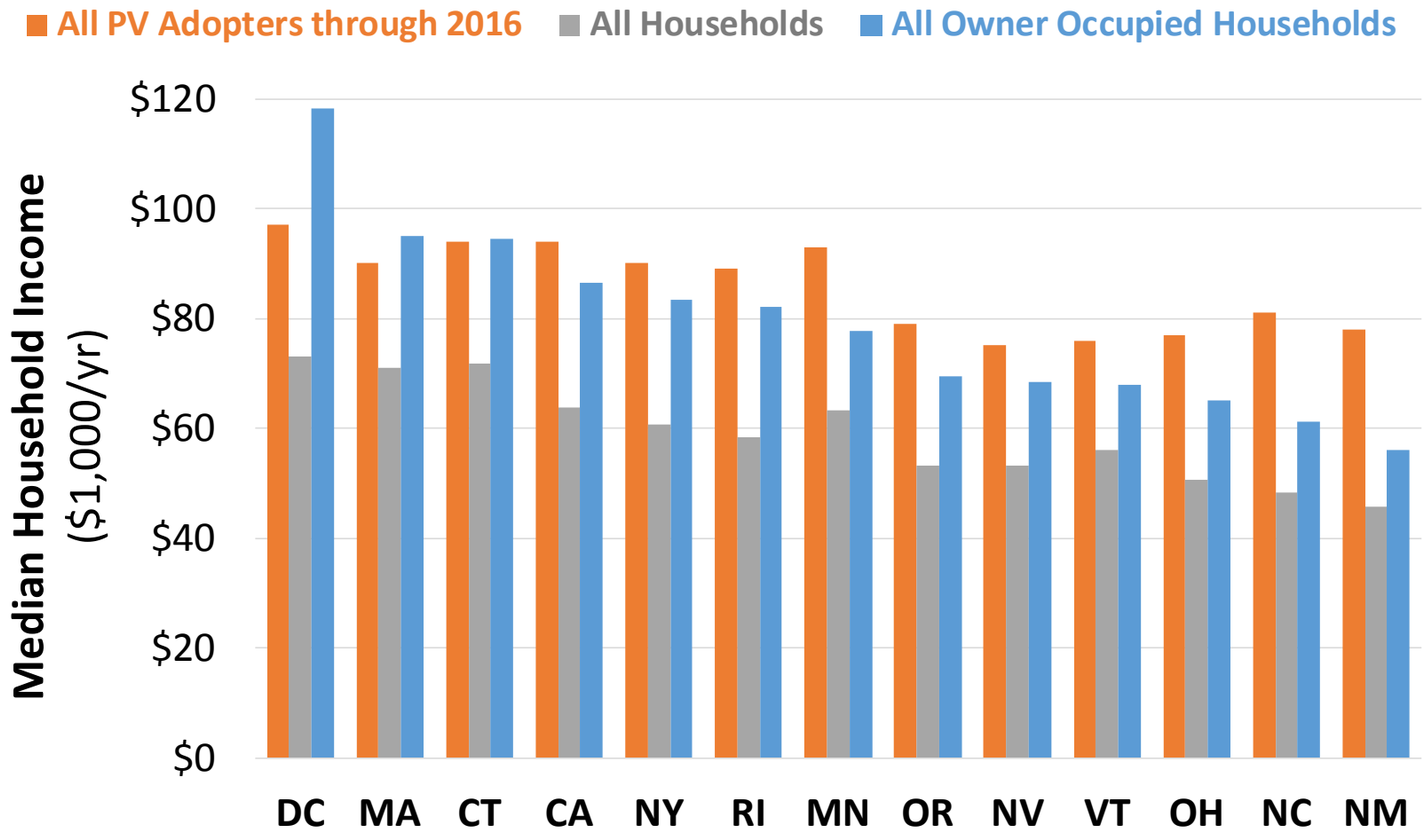


Notes: *Multi-state median incomes are calculated as a weighted average of each individual state median, weighted based on the relevant population (i.e., the population of PV adopters, all households, or all owner-occupied households).*

- Median income of all PV adopters in the sample is $32k (54%) higher than all HH
- But more than half of that difference is associated with home ownership
  - Home ownership rates much higher for HHs above state median income (77%, on average) than below (44%); see slide 31 in appendix for additional details
  - Standard "split incentive" barrier endemic to distributed energy resources generally, including energy efficiency
- Median income of PV adopters is $13k (17%) higher than that of all OO-HH
- Gap is amplified by the concentration of PV adopters in relatively high-income states
  - Pulls PV median upward, while medians for all HHs and OO-HHs reflect distribution of broader population

Similar trends exhibited in most states, with greatest PV-adopter income disparities in states with relatively low statewide incomes

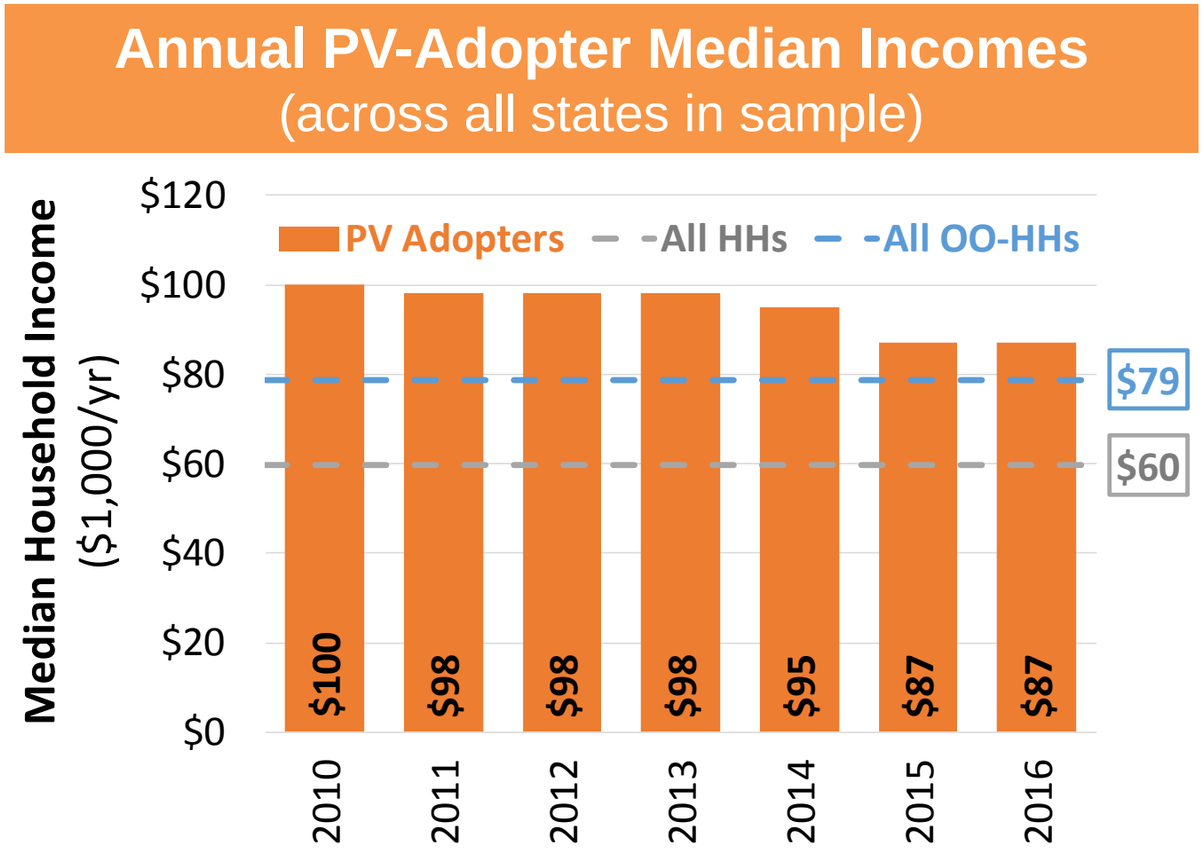
Median Incomes by State



Notes: *States ordered from highest to lowest based on median income of all owner-occupied households.*

- PV-adopter median incomes across the 13 states in the sample are ~$20k-$30k (30%-70%) higher than for all HH
- Differences consistently much smaller when comparing to just OO-HH
- Gap between PV adopters and all OO-HHs vary with overall statewide income levels
  - Gap is smaller for high-income states—and is even inverted for the three states (DC, MA, CT) with the highest statewide incomes
  - In states with relatively low statewide incomes, PV-adopter incomes are also lower, but not to the same extent as the overall population of OO-HHs

PV-adopter median incomes converging toward broader population

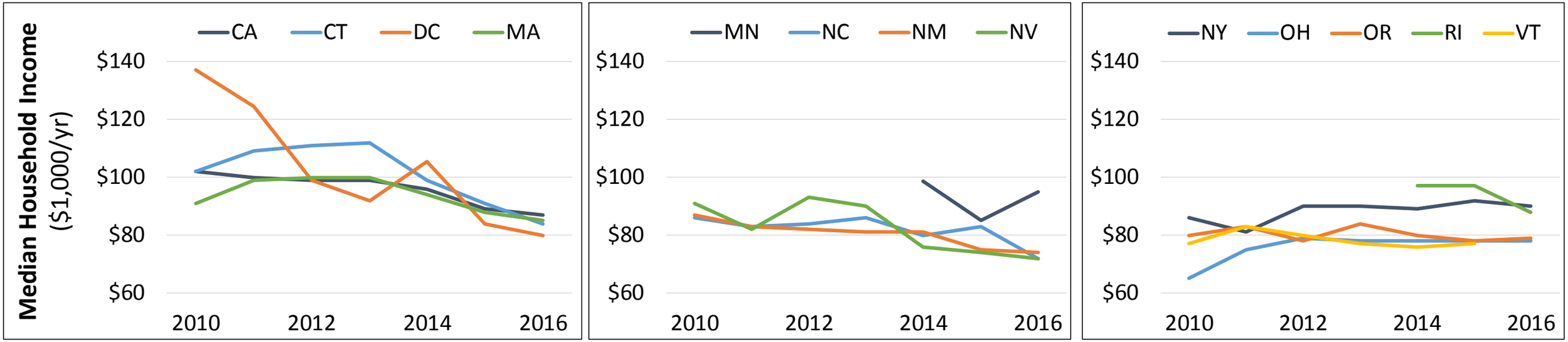


Notes: *See earlier slide for method used to calculate multi-state median incomes. Income levels for PV adopters in each year are based on estimated current income of those HHs, not the income in the year of installation. Accordingly, the reference incomes shown for all HHs and all OO-HHs are fixed over time based on the latest Census data.*

- Prior results focused on all PV adopters cumulatively, but annual trends show that PV-adopter median incomes have been trending downward in recent years
- PV adopters converging toward median income of all OO-HHs: PV-adopter median income 10% higher than all OO-HHs in 2016 ($87k vs. $79k), compared to 27% higher in 2010
- Figure here focuses on period since 2010; later slide contrasts these trends with the earlier era
- Aggregate PV-adopter median income across all states is driven heavily by CA, but most states show similar downward trend

Most states show a decline in PV-adopter median incomes over time

Annual PV-Adopter Median Income by State

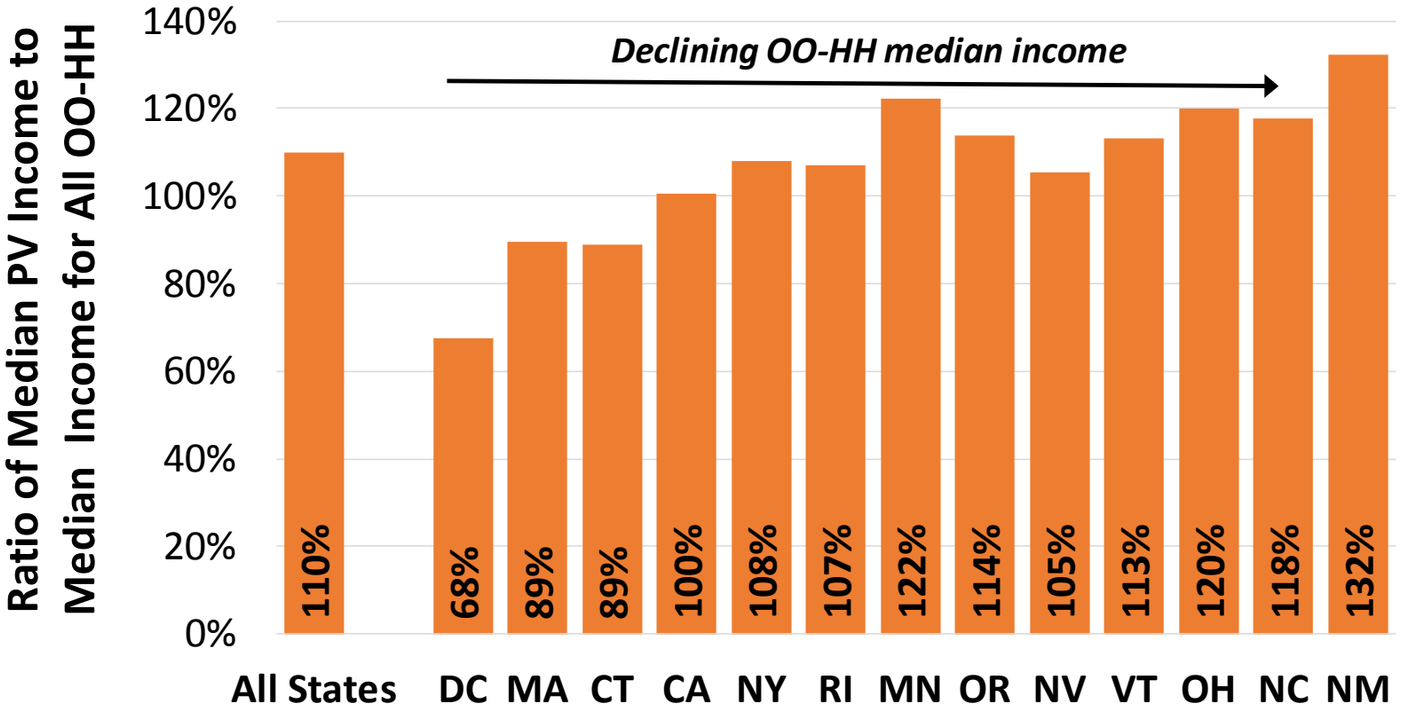


Notes: *States divided among figures alphabetically, simply to aid visual comprehension. For several states (MN, RI, VT), sufficient sample sizes are available for only a portion of the time period shown. Income levels for PV adopters in each year are based on estimated current income of those HHs, not the income in the year of installation.*

- Notwithstanding some inter-annual volatility, median PV-adopter incomes in most states have generally been trending downward in recent years
- Some states (NY, OH, OR, VT) show little change or even slight increases in PV-adopter incomes over the period shown, but these also tend to be states with relatively low PV incomes

2016 PV-adopter median incomes in most states were greater than other OO-HHs, though four states have reached "income parity"

PV-Adopter Median Incomes *Relative* to Median Income of all OO-HHs (2016 PV Adopters)

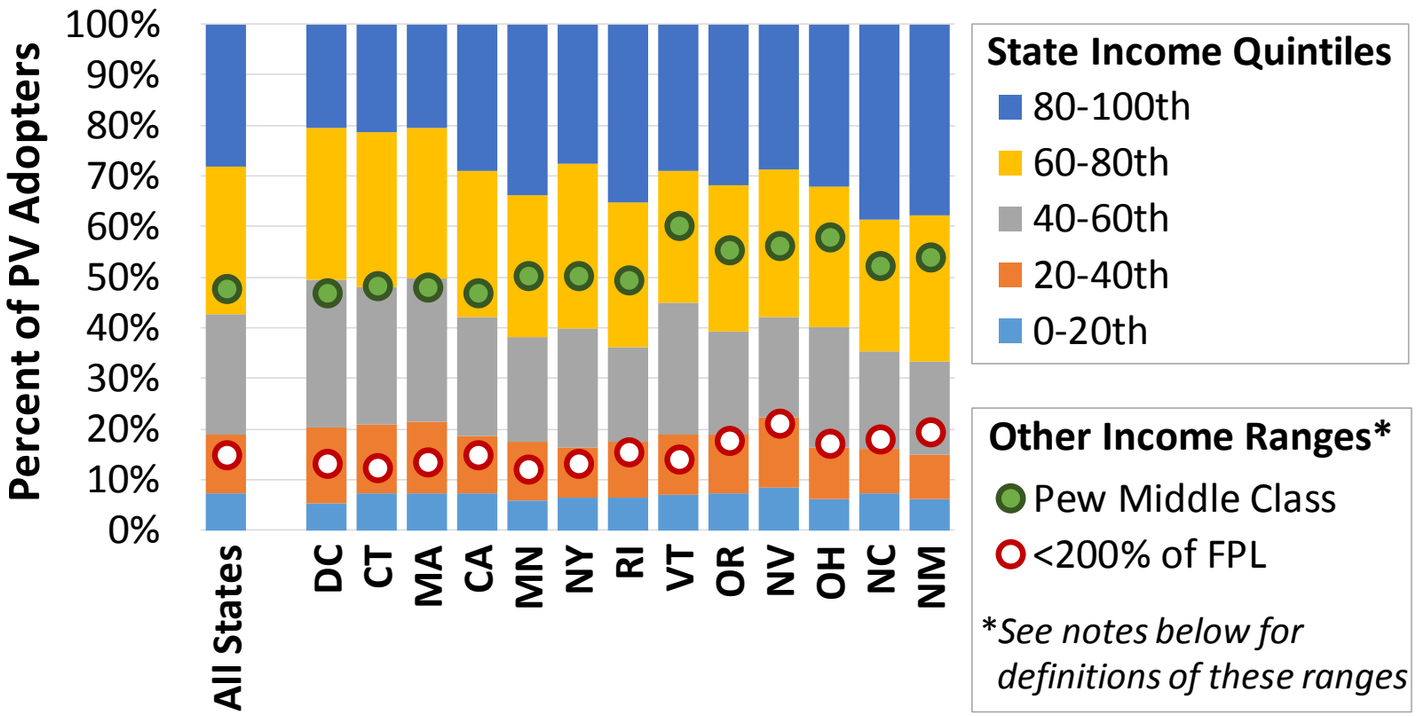


Notes: *States ordered from left to right according to declining median income of all OO-HHs (see slide 13 for those values). For VT, we use data for 2015 PV adopters, owing to the limited sample size for 2016.*

- Across the 13 states in the sample, PV-adopter median incomes in 2016 ranged from 68%-132% of the median income for all OO-HHs
- Four states (DC, MA, CT, CA) have reached "income parity", with PV adopter median incomes equal to or below other OO-HHs
- For reasons discussed previously, variation in results across states is strongly associated with the overall median income of OO-HHs
  - Lower ratio of median income in states with higher overall incomes for OO-HHs

Even if often under-represented, "moderate-income" households nevertheless constitute a sizeable share of cumulative PV adopters

Income Distribution of All PV Adopters through 2016

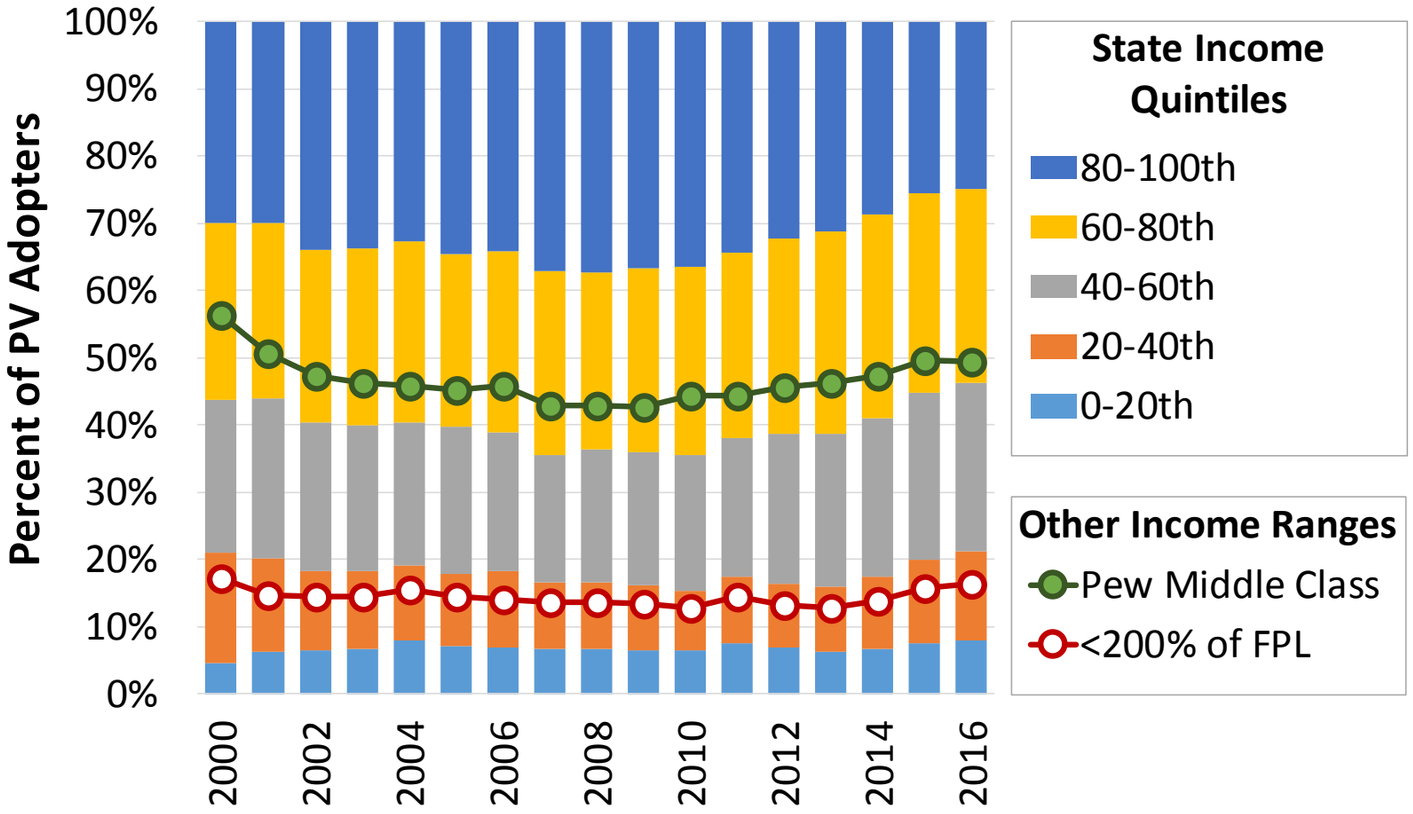


Notes: *States ordered left to right according to declining median income of all OO-HHs. Income quintiles based on all HHs in each state; the distribution for "All States" uses the quintiles for each PV adopter's respective state. See slide 33 for distributions in absolute dollar terms. The Pew Research Center defines "middle class" households as those with incomes of 67% to 200% of the U.S. median household income ($53,889 in 2016). The Federal Poverty Level (FPL) was equal to $20,420 for a 3-person household in 2016.*

- 43% of all PV adopters in the sample (33%-50% across individual states) fall within the lower 3 income quintiles
- 48% of all PV adopters (47%-60% across individual states) fall within Pew's definition of "middle class" (see notes)
- Even low-income groups are represented, with 15% of all PV adopters below 200% of the Federal Poverty Level: a common benchmark used in low-income programs
  - Though some questions exist about income estimates at the lower end, discussed later
- Cross-state differences largely driven by more-general income differences across states (slide 32 shows this more clearly)

PV adoption has generally been trending towards more-moderate income HHs in recent years, in contrast to earlier trend

Income Distribution of PV Adopters by Install Year



Notes: *The distributions are based on all states in the sample. Income distribution for PV adopters in each year is based on estimated current income of those HHs, not the income in the year of installation.*

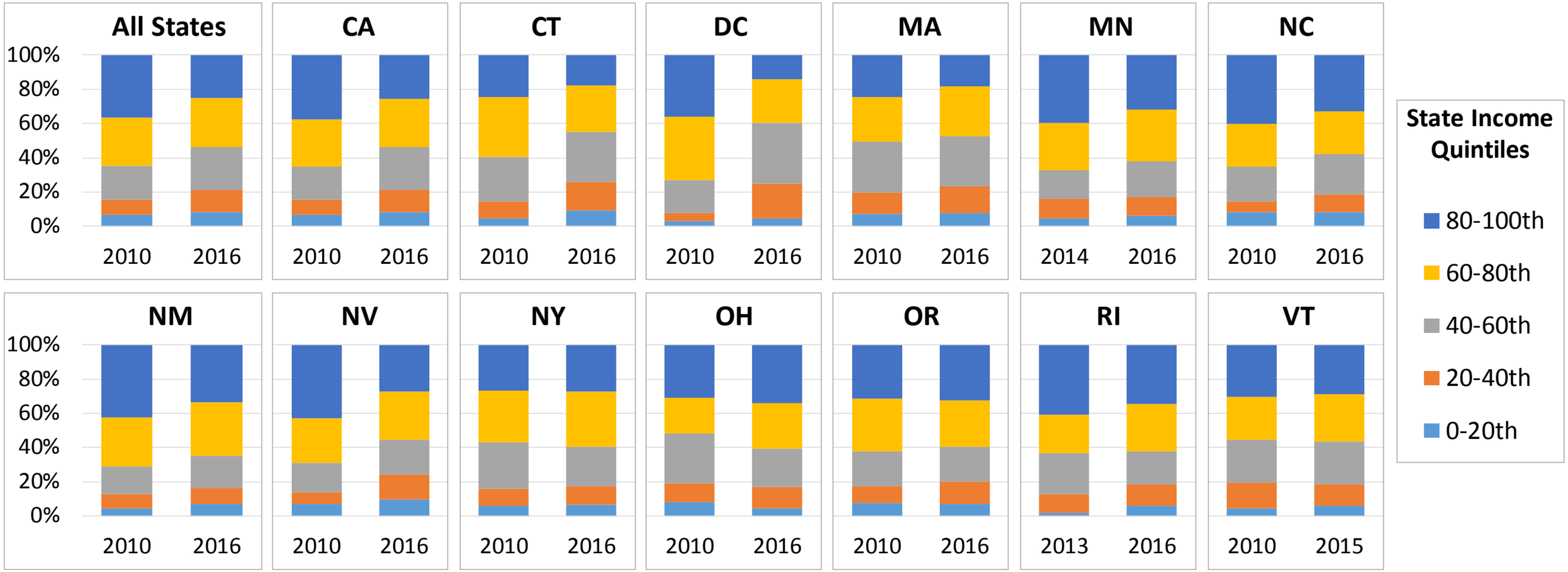
- **Prior to 2010:** PV adoption becomes increasingly skewed toward higher income households
  - Early adopters, nascent markets in most states (mostly CA)
- **Since 2010:** Share of adopters from more-moderate incomes (<60th percentile) steadily increasing
  - Rapid cost declines, growth of TPO, maturing markets, programmatic initiatives and business models targeting LMI

While the aggregate temporal trend across all states is heavily driven by CA, most other states show similar trends since 2010.

Most states also trending toward more-moderate income adopters

With some exceptions, depending on the set of income quintiles considered

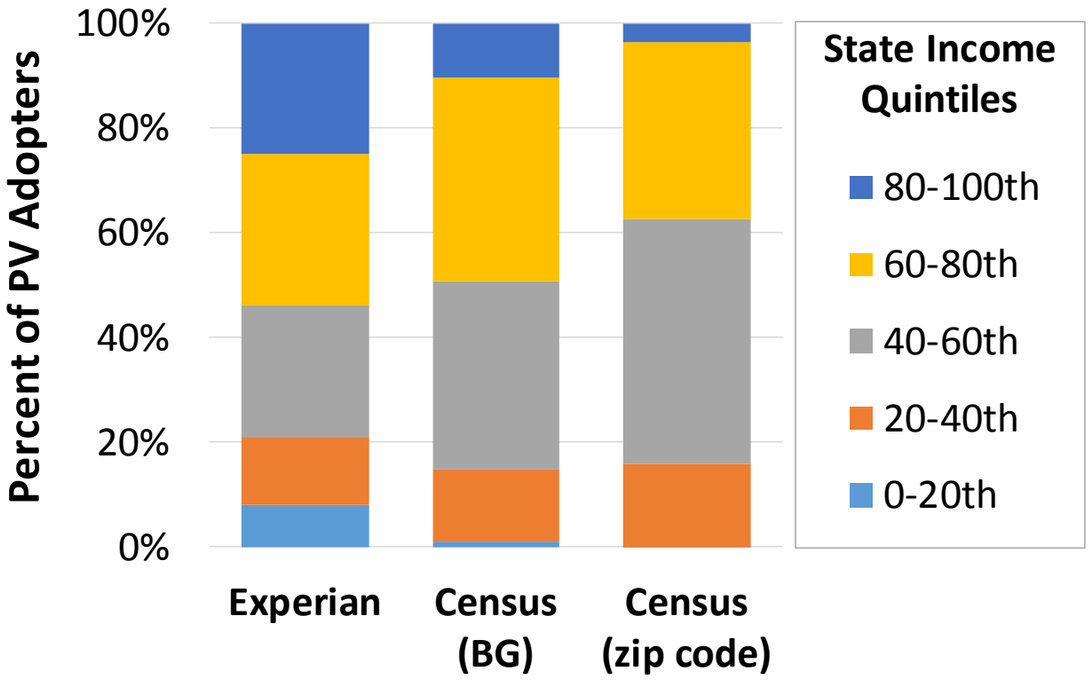
Income Distribution of 2010 vs. 2016 PV Adopters (or closest available years)



Notes: *A narrower range of years is shown for several states (MN, RI, VT) due to limited or unavailable data for 2010 or 2016. Income distributions for PV adopters in each year are based on estimated current income of those HHs, not the income in the year of installation.*

Methodological Side-Bar: Using Experian HH income estimates yields materially different results than using Census BG or zip code median incomes

2016 PV Adopter Income Distributions
Comparison of three income estimates

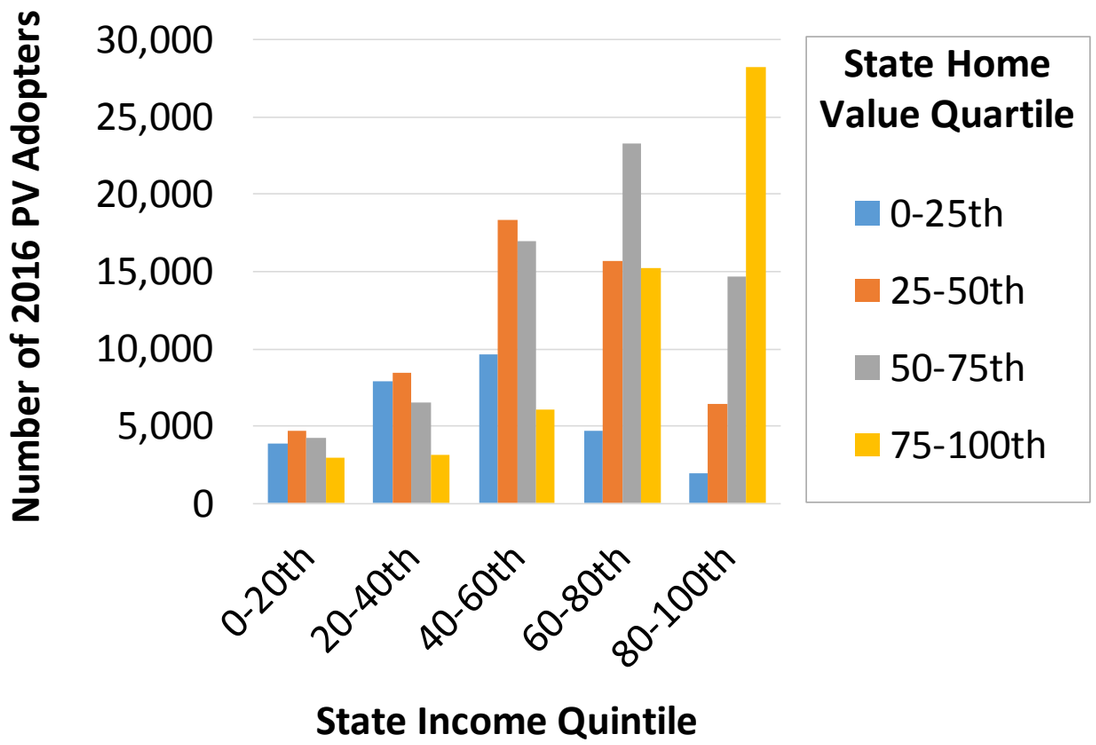


Notes: *For the Census (BG) distribution, the income assigned to each PV system is the corresponding BG median income. For the Census (zip code) distribution, the income assigned to each PV system is the average of the BG median incomes within the corresponding zip code, weighted by the residential population in each BG.*

- Prior analyses of PV-adopter income trends have often used zip-code average incomes (for want of customer street addresses) or median BG incomes (for want of HH-level income data)
  - Roughly 600 HH per BG; 3000 HH per zip code
- One of the chief innovations of the present analysis is to use HH-level income estimates for each available PV street address
- The results differ materially in two ways
  1. **Shift in the distribution toward wealthier households:** PV adopters tend to have higher incomes than other HHs in their BG and zip code
  2. **Greater representation among the "tails" of the income distribution:** Using median incomes across BGs or zip codes dampens income variability

Methodological Side-Bar: There are some questions about the accuracy of the income estimates at the lower end of the spectrum

Comparison of Income Levels vs. Home Values for 2016 PV Adopters



Notes: *The home value for each PV adopter is binned according to the distribution of home values in the corresponding state (which are available as quartiles)*

- For PV adopters in most income groups, home values more-or-less correspond to income
- However, for PV adopters in the lowest income quintile, the home-value distribution is flat, suggesting a relatively high share of these customers may not, in fact, be "low income"
  - One theory explored, but ultimately refuted, is that a disproportionate share of low-income PV adopters are retirees
- Data on participation in CA low-income electricity rates (see slide 34) also show a larger number of estimated low-income PV adopters than expected
- Possible explanations: (1) less-robust data available for the estimated income model for low-income HHs versus higher incomes; (2) the process of fitting income estimates to census data may skew low-income results

Estimating LMI Adoption Rates

PV Adoption Rate: *Number of PV adopters divided by total number of (applicable) HH*

- We estimate adoption rates among all HHs and among just OO-HHs, on both a cumulative and annual basis
- We assume that the income distribution of our PV-adopter sample for each state is representative of all PV adopters in the state
- We compare adoption rates for LMI households vs. overall PV adoption rates → provides a measure of whether and to what extent LMI adoption lags behind the broader market

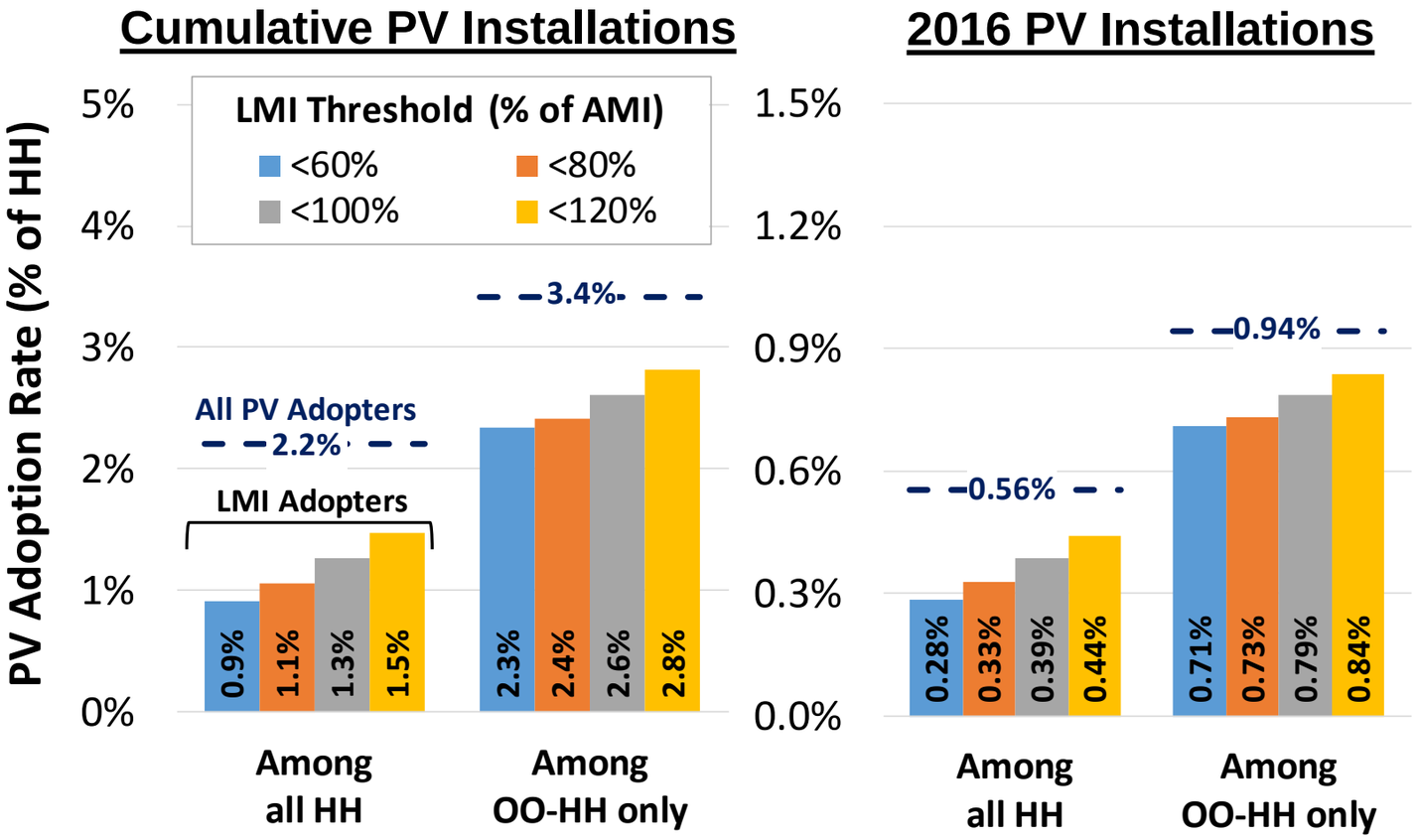
Defining "LMI": *Following the convention of many LMI-oriented solar programs, we classify households as LMI based on their income relative to Area Median Income (AMI)*

- Specific AMI thresholds vary by program (typically anywhere from 60% to 120% of AMI), depending in part on whether the focus is just on *low*-income or on *low- and moderate*-income
- Side note: Using state median incomes rather than AMI yields almost identical LMI adoption rates for most states (suggesting that PV adopters are relatively well-dispersed within each state)

PV adoption rates by LMI customers lag behind the broader market

Though the disparity is smaller when focusing just on OO-HHs and 2016 installs

PV Adoption Rates: LMI compared to All Incomes
Aggregate results across all states in the sample



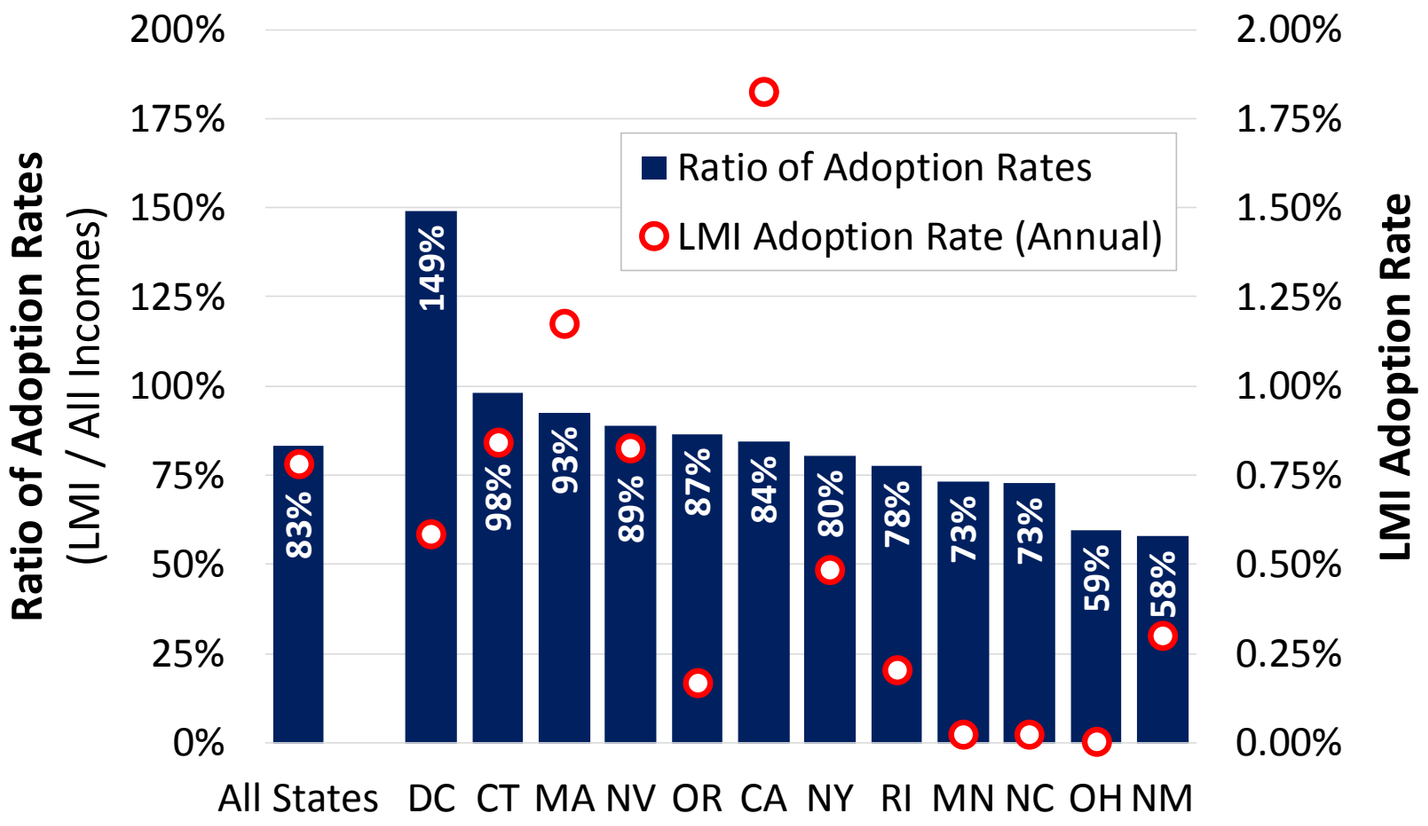
In general, results mirror and reinforce earlier comparisons of median incomes and PV-adopter income distributions

- In aggregate across all states in the sample, the LMI adoption rate is below the overall market adoption rate
- The gap is smaller for more-expansive LMI definitions (120% vs. 60% of AMI)
- The gap is also smaller, in relative terms, when focused specifically on adoption among OO-HHs (given lower rates of home-ownership among LMI customers)
- The gap is smaller among 2016 installs, as PV adoption shifts towards more-moderate income HHs, but still persists

LMI adoption in each state also tends to lag the broader market

DC is an exception, in part because of how the MSA is defined

Ratio of LMI to Overall Statewide Adoption Rates
(2016 PV installs, OO-HHs only, LMI defined as ≤100% of AMI)

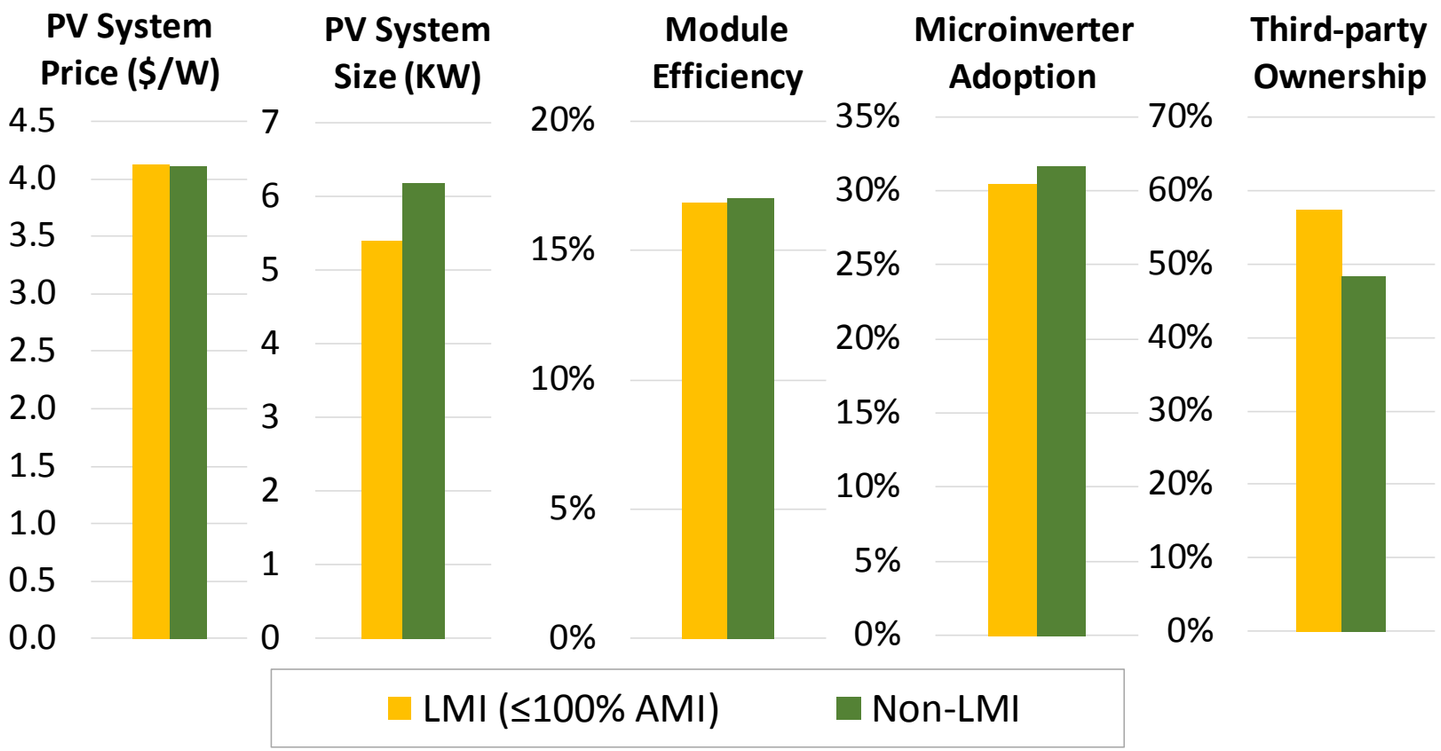


- Annual LMI adoption rates vary widely across states, from <0.01% to 1.8% of OO-HHs in 2016, using the particular LMI definition here (see slide 35 for cumulative LMI adoption rates)
- Generally range from 70-90% of the overall state adoption rate, though LMI rate is near or above broader market rate in several states (DC, CT, MA)
- In general, less lag in states with higher overall incomes, as LMI HHs in these states have higher absolute income levels
- This dynamic further accentuated in DC, as it is part of a larger MSA that includes high-income areas of VA and MD, further raising the absolute income threshold for LMI

LMI PV systems tend to be somewhat smaller, more likely to be TPO

But few apparent differences in system price, module efficiency, or microinverter use

PV System Characteristics for LMI vs. Non-LMI
(2016 PV Installations, LMI defined as ≤100% of AMI)



Notes: *Figure is based on all systems in the analysis sample installed in 2016 for which the relevant data (e.g., module efficiency, inverter type, system ownership type) are available.*

- **Median system size: ~5.4 kW** for LMI customers (≤100% of AMI) vs. **6.2 kW** for non-LMI customers
  - Larger systems cost more, and lower-income HHs are more constrained financially; LMI HHs may also have less energy consumption to offset and smaller roofs
- **Third-party ownership (TPO): 57%** of LMI customers vs. **48%** for non-LMI
  - LMI HHs may have greater cash constraints, less access to other financing options, and less ability to directly monetize tax benefits

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Conclusions

- **The choice of data and metrics clearly matter:** For example, results and associated take-away messages can differ significantly depending on use HH-level data vs. Census BG medians or zip-code average incomes; and depending on whether PV adopters are compared to all HH or just OO-HHs
- **Home-ownership is a key driver for differences in PV adoption among income groups:** Reinforces importance of business models and programs aimed at renters
- **PV-adopter incomes are diverse:** While PV adopters as a whole are higher-income than the population at large, it should not be overlooked that “moderate-income” or “middle-class” households are already a significant beneficiary of existing solar markets
- **The income profile of residential PV adopters is dynamic and evolving:** Suggests some value in periodically re-assessing PV-adopter income trends, and raises questions about the underlying drivers for recent trends and about how those trends may evolve going forward
- **Local and regional factors impact the income characteristics of PV adopters:** Though much of the cross-state variation in PV income trends is a function of more-general statewide income differences, other market and policy drivers likely play a role as well, and could become more significant in the years ahead

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Analysis Sample: Data Sources

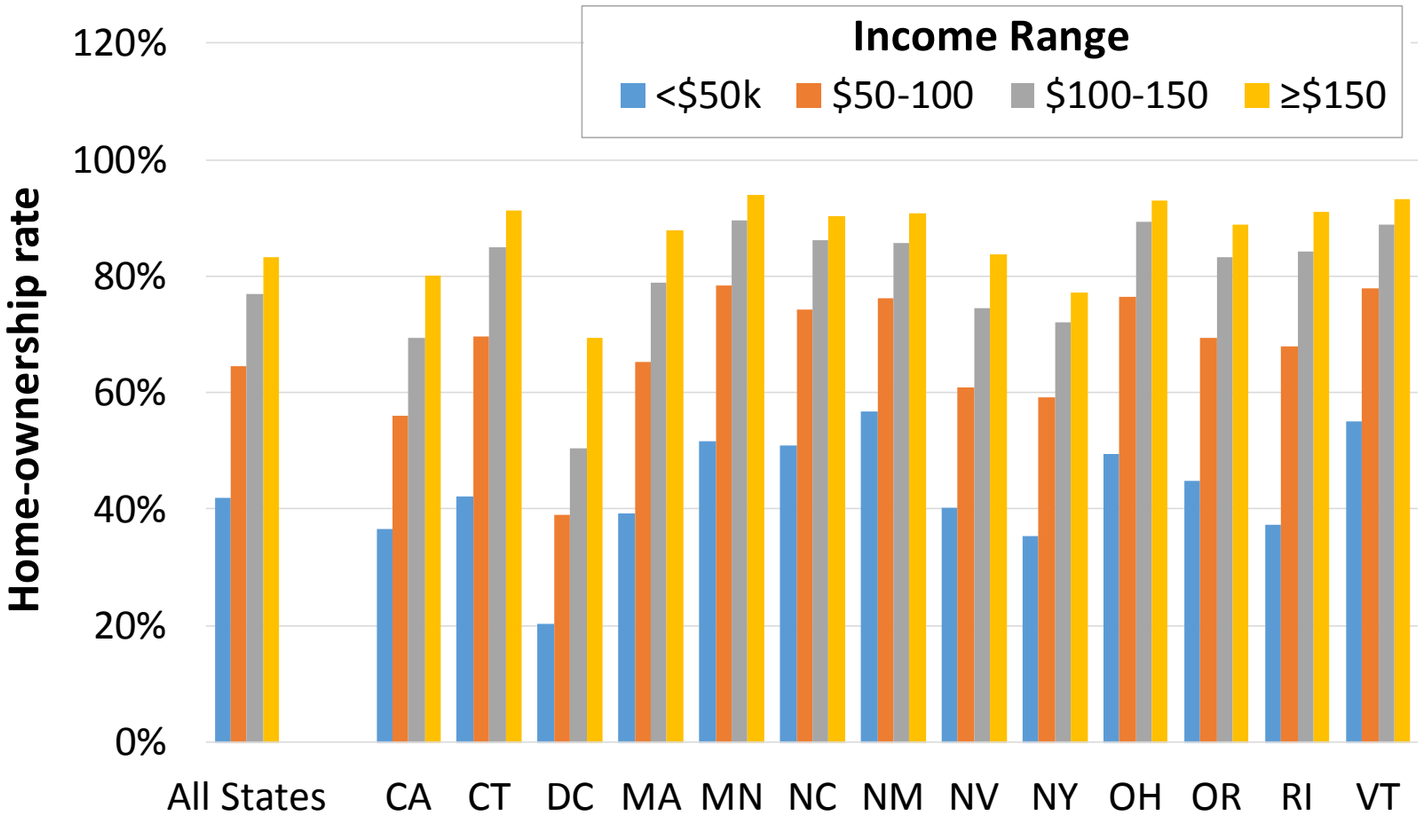
State	Data Sources	Analysis Sample	Market Coverage	Notes
CA	**CPUC:** Currently Interconnected Dataset, CSI Working Dataset, Self-Generation Incentive Program **CEC:** New Solar Homes Partnership, Emerging Renewables Program **Imperial Irrig. District:** All net-metered systems, California Solar Initiative	595,892	92%	Projects matched across overlapping datasets to avoid double-counting
CT	**CT Green Bank:** Various incentive programs	18,989	82%	
DC	**DC PSC:** Systems certified for RPS eligibility	2,572	94%	
MA	**MA DOER:** SREC I and SREC II certified systems **MassCEC:** Various incentive programs	61,418	95%	Projects matched across overlapping datasets to avoid double-counting
MN	**MN Dept. of Commerce:** Made in Minnesota program	597	26%	Only includes data on 2014-2016 installs
NC	**NC Sustainable Energy Association:** Applications with the NC PUC for a CPCN	4,689	93%	
NM	**NM Energy, Minerals & Natural Resources Dept:** State income tax credit program **PNM:** All interconnected systems	10,581	87%	Data from the state tax credit program includes only host-owned systems. Projects matched across overlapping datasets to avoid double-counting.
NV	**NV Energy:** All interconnected systems	20,150	85%	
NY	**NYSERDA:** Various incentive programs	47,340	64%	Market coverage relatively low because street address data unavailable for a substantial fraction of systems
OH	**OH PUC:** All in-state systems certified for RPS eligibility	1,765	66%	Market coverage relatively low because a substantial fraction of street addresses could not be matched with either a HH or zip+4-level income estimate
OR	**Energy Trust of Oregon:** Various incentive programs **OR Dept. of Energy:** State income tax credit programs	11,693	94%	Projects matched across overlapping datasets to avoid double-counting
RI	**RI Commerce Corporation:** Various incentive programs **National Grid:** All net-metered systems and all systems participating in RE Growth Program	1,936	97%	Projects matched across overlapping datasets to avoid double-counting
VT	**VT Energy Investment Corporation:** Various incentive programs	3,558	59%	PV incentives expired in 2015, thus effectively no market coverage of 2016 installations

Analysis Sample: Annual PV Adopters by State

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CA	85	900	1,572	2,616	4,111	3,826	5,878	8,602	8,972	15,194	19,011	26,627	36,507	65,074	94,423	150,110	152,339
CT	0	0	0	0	0	32	87	165	269	469	475	404	597	1,285	3,139	6,693	5,374
DC	0	0	0	0	0	1	2	3	5	89	178	178	207	309	362	615	624
MA	1	1	0	50	98	60	197	181	319	686	545	1,093	2,907	4,804	8,970	20,295	21,215
MN	0	1	0	0	1	0	1	1	0	0	0	0	0	0	114	189	290
NC	0	0	0	0	0	3	13	20	40	102	179	350	444	435	846	1,274	991
NM	1	4	6	7	11	7	60	65	152	382	905	1,086	1,162	1,203	1,197	1,733	2,610
NV	0	0	0	0	8	58	72	92	82	166	279	127	55	235	1,410	14,587	2,979
NY	0	0	0	37	84	86	188	326	360	669	684	699	1,563	2,271	5,762	15,650	18,964
OH	0	0	1	2	4	5	9	16	27	65	137	285	240	234	248	293	199
OR	23	46	31	84	140	96	149	220	245	456	1,104	1,322	1,342	986	1,307	2,006	2,127
RI	0	0	0	0	0	0	0	1	2	1	3	0	35	54	86	339	1,415
VT	0	0	0	1	63	36	54	61	85	147	177	377	473	807	931	332	15
Total	**110**	**952**	**1,610**	**2,797**	**4,520**	**4,210**	**6,710**	**9,753**	**10,558**	**18,426**	**23,677**	**32,548**	**45,532**	**77,697**	**118,795**	**214,116**	**209,142**

Home-Ownership Rates for All Households

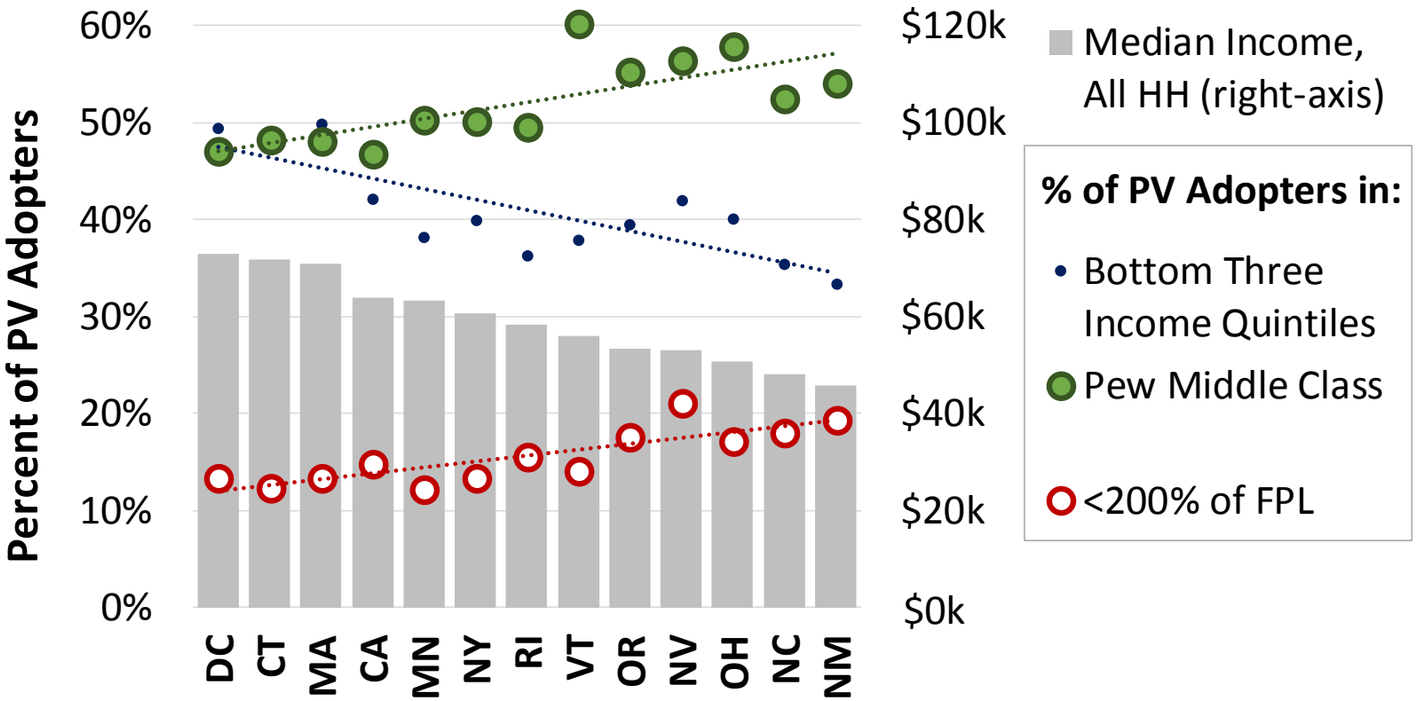
Home-Ownership Rate by Income Group
(All households, not specific to PV customers)



- The figure presented here provides further detail illustrating lower rates of home ownership for lower income households
  - Home-ownership rates are roughly double for HHs above $150k (83% across all 13 states) than for those below $50k (42%)
- As discussed throughout the report, higher income groups represent a disproportionate share of residential rooftop PV adopters, and have higher adoption rates, in large part as a result of differences in home-ownership rates across income groups

Differences in PV-adopter incomes across states is partly a function of more-general differences in statewide incomes

Comparison of PV-Adopter Income Statistics with Each State's Median HH Income

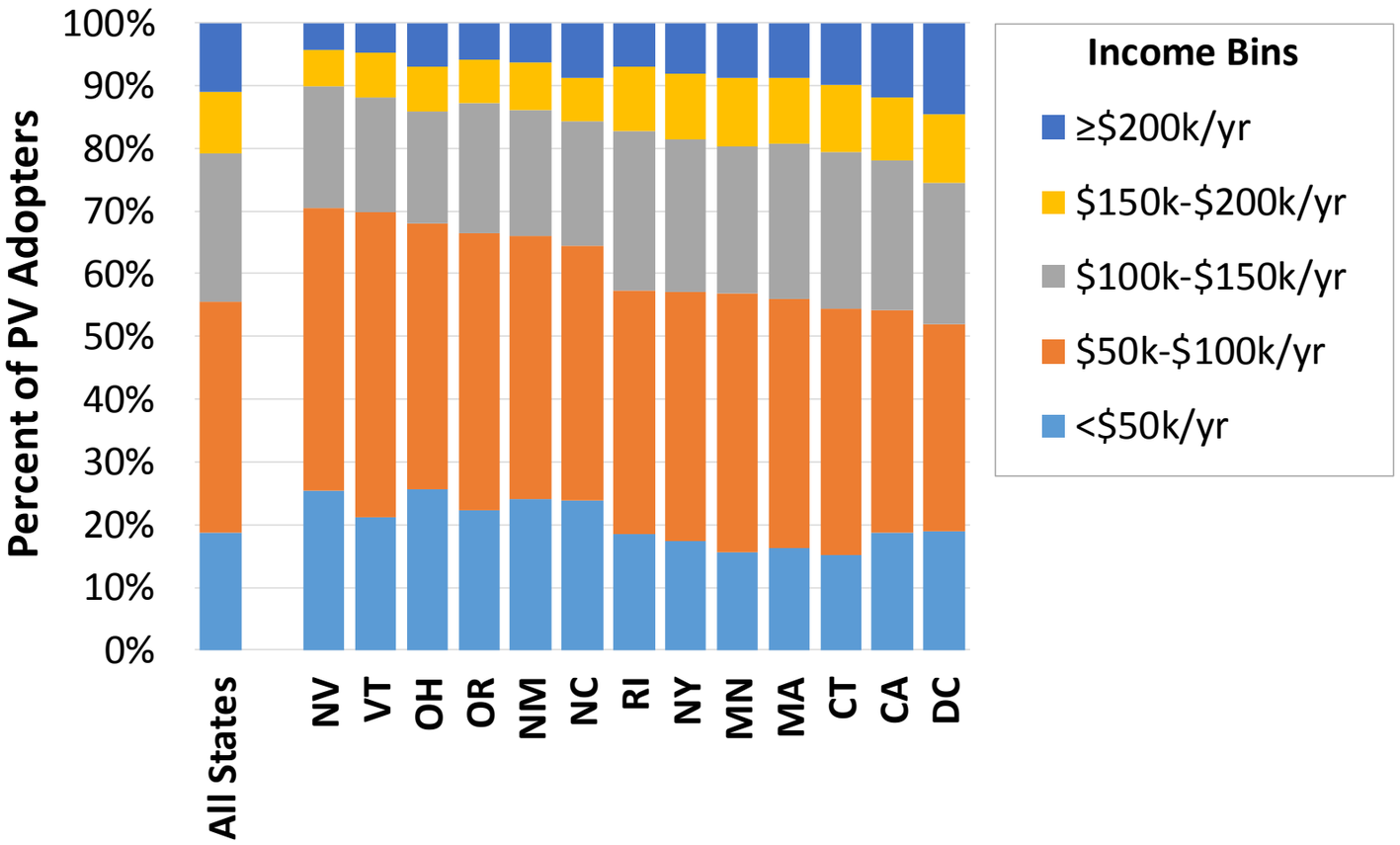


Notes: *States ordered from highest to lowest based on median income of all households. The trend-lines included in the figure are intended to illustrate the general direction of the trend, but the specific slopes of those lines do not have any technical significance given that the x-axis is non-numeric.*

- In states with relatively high incomes:
  - Income quintiles shifted upward; thus PV more-accessible to HHs in the bottom three quintiles
  - Smaller fraction of population is <200% of FPL and in Pew middle class; fraction of PV adopters in those groups thus also smaller
- Converse is true for states with lower overall income levels
- More of a "mathematical" phenomenon than an empirical one
- Other cross-state differences in PV-adopter income trends (as suggested by deviations from the trend-lines) may be driven by policy and market factors

PV-Adopter Income Distribution in Terms of Absolute Income Levels

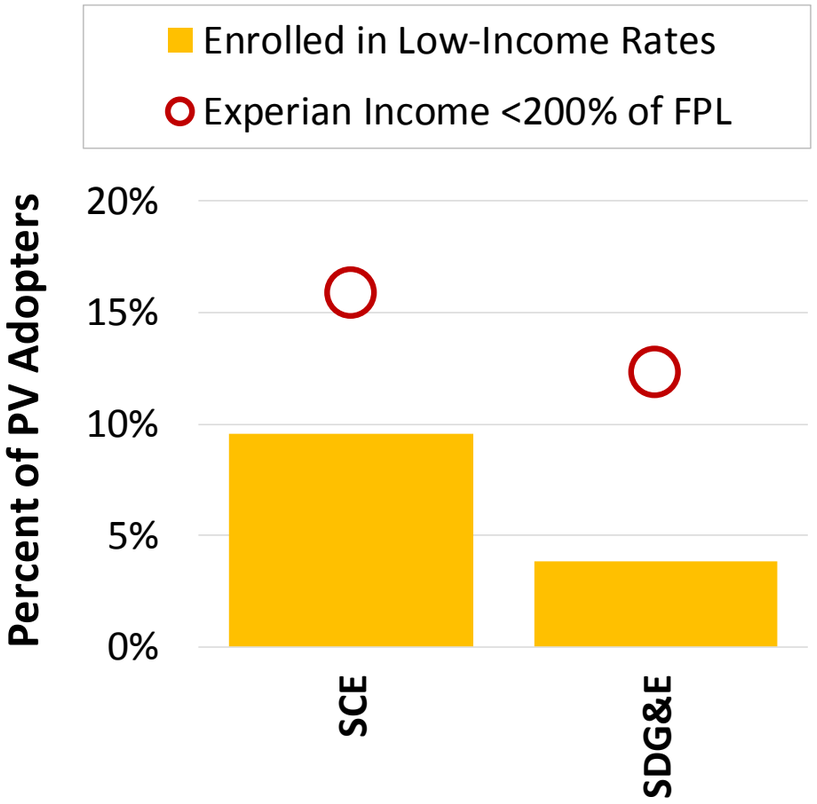
Income Distribution of PV Adopters



- This figure supplements the income distribution presented earlier, which uses state income quintiles
- Reinforces the same basic conclusion that "moderate-income" households comprise a sizeable share of PV adopters
  - 55% of all PV adopters in the sample have HH income <$100k (~50-70% across the individual states)
- Cross-state differences highly correlate to overall statewide income levels
  - E.g., greater share of PV adopters <$100k in states with relatively low statewide income (see previous slide), given the greater share of the overall population below that income level

Benchmarking Experian Income Estimates against PV-Customer Enrollment in Low-Income Rates for California IOUs

Experian Data vs. Enrollment in Low-Income Rates

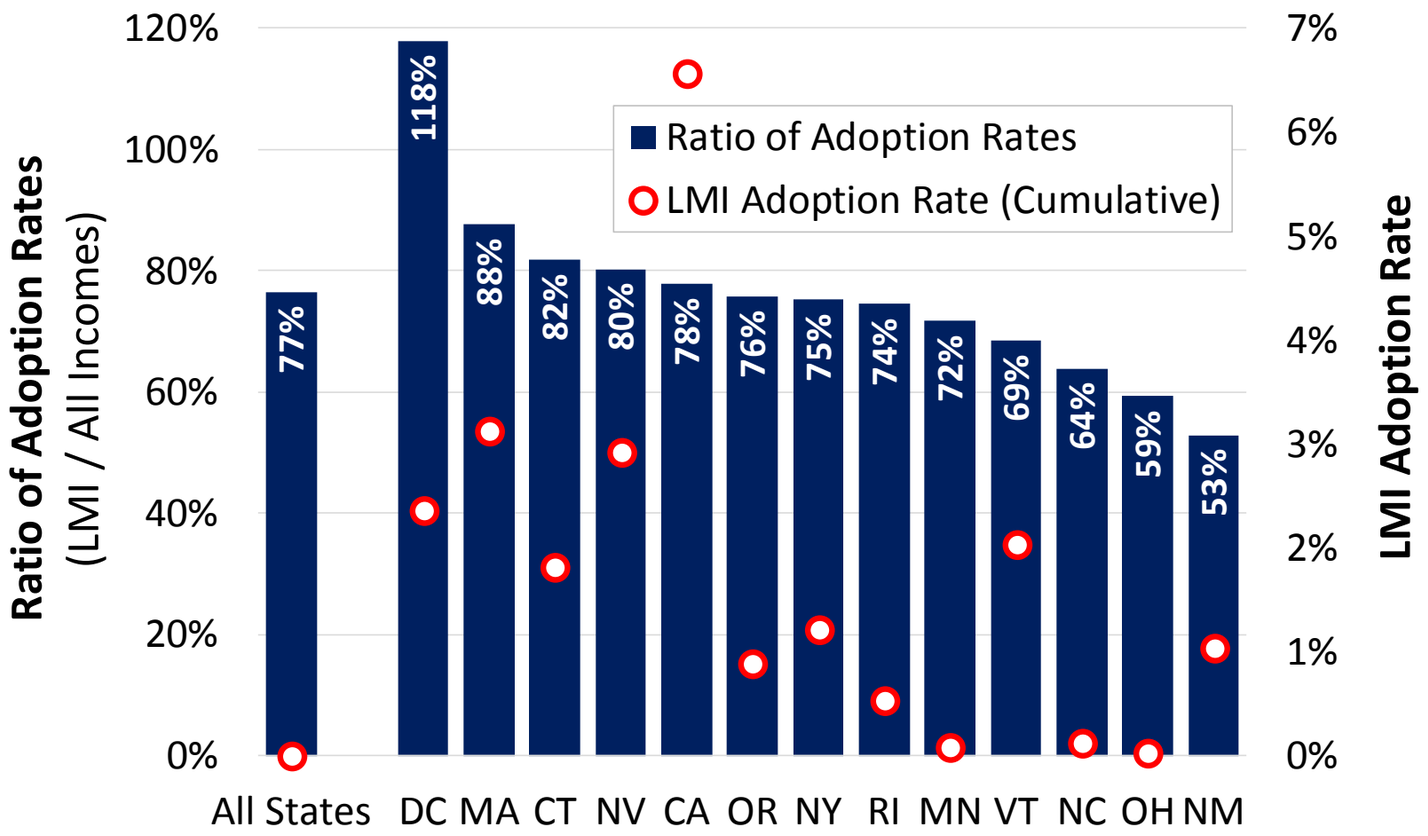


- California's IOUs offer low-income electricity rates; eligibility is based on HH income <200% of the FPL
- LBNL receives data from the CPUC on the retail electricity tariff in which each PV customer is enrolled (at the time of interconnection)
  - We focus here on just SCE and SDG&E, due to issues with the rate data for PG&E
- As shown in the figure, enrollment in low-income rates by PV customers is much lower than the estimated percentage of eligible PV customers (10% vs. 16% for SCE, 4% vs. 12% for SDG&E)
  - One explanation is simply that some customers may be eligible for low-income rates but do not enroll
  - It may also indicate a larger number of estimated low-income households (with income <200% of FPL) than expected for these utilities (for reasons discussed on slide 21)

LMI adoption in each state also tends to lag the broader market

DC is an exception, in part because of how the MSA is defined

Ratio of LMI to Overall Statewide Adoption Rates
(Cumulative installs, OO-HHs only, LMI defined as ≤100% of AMI)



- LMI PV adoption rates vary widely across states, from <0.1% to 7% of OO-HHs, using the particular LMI definition here
- Generally range from 60-80% of the broader market adoption rate
- Lag in LMI adoption rates generally less acute in states with higher overall incomes
  - Consistent with earlier discussion, LMI HHs in these states have higher absolute income levels, and thus greater access to PV
- Results for DC also impacted by the fact that it is part of a larger MSA that includes high-income areas of VA and MD, further raising the LMI threshold

For Further Information

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