



Incentive Step-Down Analysis: July 2020

Summary

- [Decision 17-12-022](#) (Section 4, pages 39-43) discusses SOMAH's incentive structure and decides that, "Under the structure adopted here, incentive levels will decrease by the annual percent decline in residential solar costs as reflected by NREL reports, or 5% annually, whichever is less."
- Following Decision 17-12-022, the SOMAH PA examined changes in the cost of residential solar energy systems from 2017 and 2018, the most recent years available for the technical report series entitled, "U.S. Solar Photovoltaic System Cost Benchmark" produced by the National Renewable Energy Laboratory (NREL).
- In its 2018 Q1 technical report, NREL reported the following national residential benchmark costs:
 - 2017 benchmark in 2018 USD: \$2.84 per Watt, DC
 - 2018 benchmark in 2018 USD: \$2.70 per Watt, DC
- The PA also analyzed NREL's California-specific data, which yielded the following residential benchmark costs:
 - 2017 benchmark in 2018 USD: \$2.94 per Watt, DC
 - 2018 benchmark in 2018 USD: \$2.75 per Watt, DC
- Step-down, or percentage decrease is calculated by $[(\$2.84-\$2.70)/\$2.84]*100 = 4.93\%$ (national) and $[(\$2.94-\$2.75)/\$2.94]*100 = 6.46\%$ (which defaults to 5% per the Decision) (California), and given either value, SOMAH incentives levels for the July 1, 2020 to June 30, 2021 program year are as follows:

Tax Credits		\$ per AC Watt Incentive			
ITC	LIHTC	Tenant		Common	
		2019-2020	2020-2021	2019-2020	2020-2021
No	No	\$3.20	\$3.04	\$1.10	\$1.04
Yes	No	\$2.25	\$2.14	\$0.80	\$0.76
No	Yes	\$2.25	\$2.14	\$0.80	\$0.76
Yes	Yes	\$1.60	\$1.52	\$0.60	\$0.57



Incentive Step-Down Analysis: July 2020

Analysis

This section provides a detailed summary of how the SOMAH PA calculated an incentive step-down of 5% for SOMAH's second program year spanning July 1, 2020 to June 30, 2021.

Incentive Period

- The SOMAH program launched on July 1, 2019.
- Given the Decision's direction that incentives decrease annually, SOMAH's first-year incentive levels expire on June 30, 2020, and new incentive levels for the program's second year will go into effect on July 1, 2020, the anniversary date of the program launch. This timeline for the step-down is described in the SOMAH Program Handbook, [Section 3, Incentive Structure](#), which states, "The annual reduction will occur at the 12-month point from the program launch date."

Report Series

- [Decision 17-12-022](#) (section 4.1, pages 39-43) discusses SOMAH's incentive structure and decides that, "Under the structure adopted here, incentive levels will decrease by the annual percent decline in residential solar costs as reflected by NREL reports, or 5% annually, whichever is less."

The National Renewable Energy Laboratory produces a number of interrelated work products pursuant to solar technology cost analysis. Those work products are hosted on its website under a page called "Solar Technology Cost Analysis."¹

NREL organizes this work into four (4) areas of specialization:

- Solar Manufacturing Cost Analysis
- **Solar Installed System Cost Analysis**
- Solar Levelized Cost of Energy Analysis
- Solar Supply Chain and Industry Analysis

Reporting under the "Solar Installed System Cost Analysis" area is the most relevant, out of the areas of specialization. Under this area of specialization, NREL produces two types of work products: a technical report series called the "U.S. Solar Photovoltaic

¹ Solar Technology Cost Analysis, NREL, <https://www.nrel.gov/analysis/solar-cost-analysis.html>.



Incentive Step-Down Analysis: July 2020

System Cost Benchmark” published annually each fall/winter that reviews costs in the prior calendar year, and a quarterly presentation series called “Quarterly Solar Industry Updates” that are published quarterly and reviews costs across an approximate 3-month period, often spanning two calendar quarters. The SOMAH PA is required to examine the technical report work product rather than the less formal standalone presentation series.

The Decision references NREL’s technical report, entitled “U.S. Photovoltaic Prices and Cost Breakdowns: Q1 2015 Benchmarks for Residential, Commercial, and Utility-Scale Systems,” and summarizes stakeholder comments supporting the idea that technical reports, specifically those produced by national labs, may be used to step down annual incentive amounts. Following its recap of stakeholder comments, the Decision then directs the SOMAH PA to use “NREL reports” to calculate SOMAH’s step-down.

Beginning in 2016, this specific technical report series was slightly renamed but shares a structure and authors with the version mentioned by parties in the Decision from 2015. The SOMAH PA believes this is the most appropriate NREL report to use for the incentive step-down analysis because it is the only NREL report series referenced specifically in the Decision and is focused on cost rather than price, which are distinct values.²

The Decision also mentions by name a related report series entitled, “Tracking the Sun,” produced by Lawrence Berkeley National Laboratory, a related, though distinct, federally-funded research and development center from NREL. The NREL report analyzes solar costs, whereas the LBNL report analyzes solar prices, which have distinct definitions,³ further supporting the use of NREL’s report, rather than LBNL’s report, as the

² The SOMAH PA also examined other work products, specifically the most recent available analyses from NREL and LBNL, and includes a brief summary of findings in the Appendix. The SOMAH PA considers these workproducts as outside the scope of what may be considered for step-down analysis, given their focus on price rather than cost. However, these other work products generally corroborate that prices are declining with costs for the respective reporting period covered in these work products.

³ NREL notes in its cost benchmark-focused report that, “Costs are represented from the perspective of the developer/installer; thus, all hardware costs represent the price at which components are purchased by the developer/installer, not accounting for preexisting supply agreements or other contracts. Importantly, the benchmark also represents the sales price paid to the installer; therefore, it includes profit in the cost of the hardware, along with the profit the installer/developer receives, as a separate cost category. However, **it does not include any additional net profit**, such as a developer fee or price gross-up, which is common in the marketplace.” LBNL notes in its price-focused report that, in contrast to cost benchmarks, “the market price data assembled for this report are based on whatever profit margin developers are able to capture or willing to accept, which may exceed a theoretically competitive level in markets with high search costs and/or barriers to entry.” NREL summarizes this distinction more



Incentive Step-Down Analysis: July 2020

primary source in calculating incentive step-down values. Based on the Decision's explicit reference to "NREL reports" and LBNL's focus on price rather than cost, the "Tracking the Sun" report series is ruled out as the proper source of the step-down analysis.

In summary, the SOMAH PA understands the Decision's requirement that we examine NREL's "U.S. Solar Photovoltaic System Cost Benchmark" technical report series to calculate SOMAH's annual incentive step-down value. The citation for the most recent version is provided below.

- Citation: Fu, Ran, David Feldman, and Robert Margolis. 2018. U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-72399. <https://www.nrel.gov/docs/fy19osti/72399.pdf>.
- Publication date: November 2018

Data Sets and Points

Analysis of National Data

Topline metrics in NREL's technical report rely on a cleaned, national data set with values weighted by a state's total installed capacity. The report's body also includes state-specific data points for some states, including California, analyzed in the subsequent subsection.

Whereas historic efforts like the Low-Income Weatherization Program (LIWP), the Multifamily Affordable Solar Housing program (MASH), and SOMAH exist in part to create and develop a "multifamily" segment in the solar market, no such market segment currently exists in NREL's cost analysis, and the Decision explicitly requires that we look at changes in the "residential" solar market segment to calculate SOMAH's annual incentive step down values. The most recent report at the publishing of this analysis, from November 2018, provides the relevant data points on pages viii-ix in Figure ES-1 and Table ES-2, excerpted below.

succinctly in noting, "Profit is one of the differentiators between "cost" (aggregated expenses incurred by a developer/installer to build a system) and "price" (what the end user pays for a system)."



Incentive Step-Down Analysis: July 2020

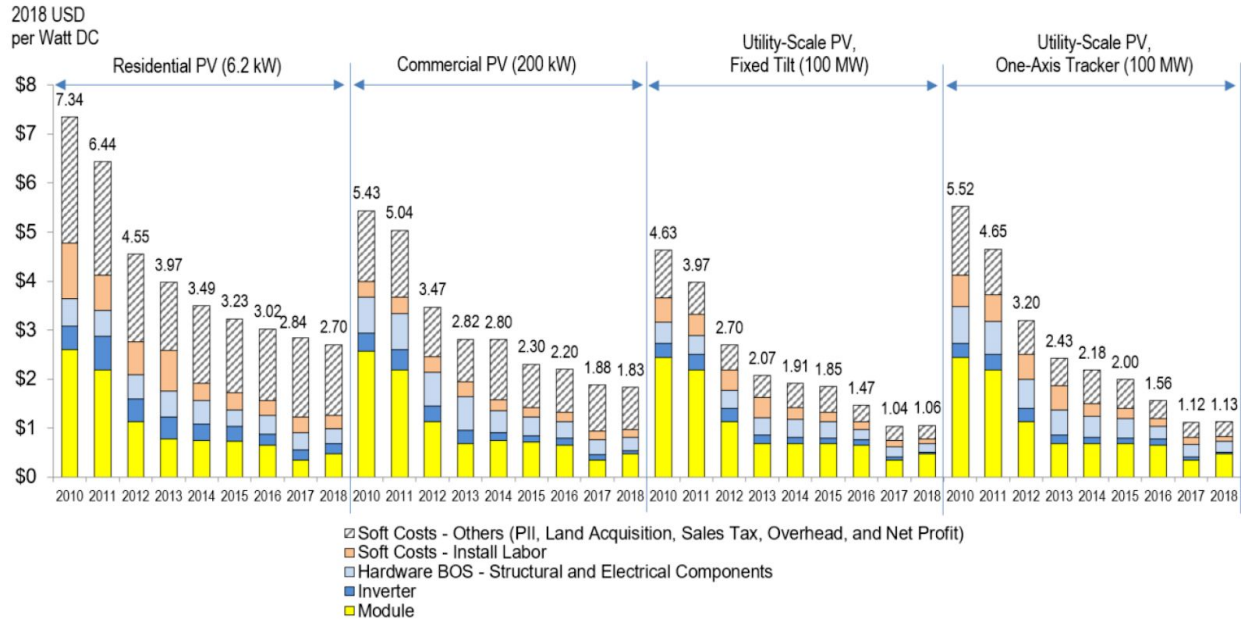


Figure ES-1. NREL PV system cost benchmark summary (inflation adjusted), 2010-2018

Table ES-2. Comparison of Q1 2017 and Q1 2018 PV System Cost Benchmarks

Sector	Residential PV	Commercial PV	Utility-Scale PV, Fixed-Tilt
Q1 2017 Benchmarks in 2017 USD/W DC	\$2.80	\$1.85	\$1.11
Q1 2017 Benchmarks in 2018 USD/W DC	\$2.84	\$1.88	\$1.12
Q1 2018 Benchmarks in 2018 USD/W DC	\$2.70	\$1.83	\$1.13
Drivers of Cost Decrease	<ul style="list-style-type: none"> Higher module efficiency Lower structural BOS commodity price Lower electrical BOS commodity price Higher labor productivity Lower supply chain costs Decrease in higher-cost module inventory Higher small installer market share Lower permitting cost 	<ul style="list-style-type: none"> Lower inverter price Higher module efficiency Smaller developer team Lower permitting and interconnection costs 	<ul style="list-style-type: none"> Lower inverter price Higher module efficiency Optimized design coefficients for wind loads 1,500 Vdc to replace 1,000 Vdc Lower developer overhead
Drivers of Cost Increase	<ul style="list-style-type: none"> Higher mixed inverter price due to higher advanced inverter adoption Higher module price Higher labor wages 	<ul style="list-style-type: none"> Higher module price Higher labor wages 	<ul style="list-style-type: none"> Higher module price Higher labor wages Higher steel prices



Incentive Step-Down Analysis: July 2020

Real vs. nominal dollar values for historical prices

Figure ES-2 provides both inflation-adjusted dollars and the contemporary/historical dollar value figure from when the report was initially published. NREL's topline metrics, including in its Executive Summary and Table ES-1, use inflation-adjusted dollar values, as is a standard practice in temporal financial analyses. This is the distinction between "real" and "nominal" dollars. Using real or nominal dollars yields different SOMAH annual incentive step-down percentage values of 3.57% or 4.93%, as is shown below. Although using the 2017 Benchmark in 2017 USD/Wdc yields a smaller step-down value, the SOMAH PA maintains the standard practice of using inflation-adjusted dollar values, in comparing the most current data for 2018, with the 2017 Benchmark in 2018 USD/Wdc. Adjusting for inflation, residential PV costs decreased nationally by 4.93% year-over-year.

Benchmark Description (National)	Cost	Change	Step-Down
Q1 2018 Benchmarks in 2018 USD/Wdc	\$2.70		
Q1 2017 Benchmarks in 2017 USD/Wdc	\$2.80	-3.57%	3.57%
Q1 2017 Benchmarks in 2018 USD/Wdc	\$2.84	-4.93%	4.93%

Analysis of California-Specific Data

The above figures rely on national data, though figures are weighted by state installed capacity, with California representing a large share of total data points. NREL also publishes state-specific cost benchmarks for the current reporting year, requiring that the SOMAH PA consider both the most recent report (covering 2018) as well as the previous report (covering 2017) to calculate changes. Year-over-year changes in cost, adjusting for inflation, are not reported at the state level in a given report.

Incentive Step-Down Analysis: July 2020

Figure 15. Q1 2017 Benchmark by Location: 5-7-kW System Cost (2017 USD/Wdc)⁴

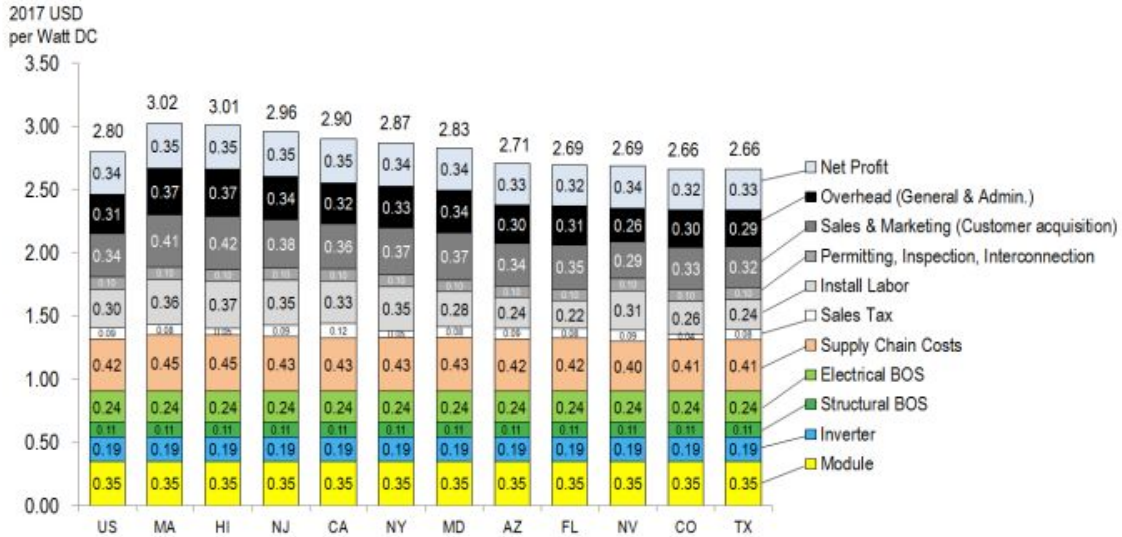
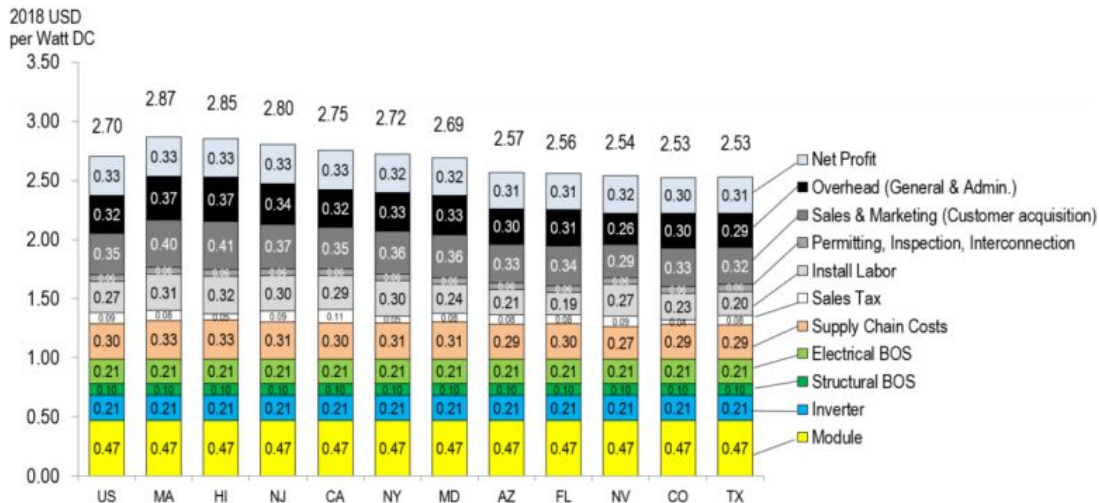


Figure 15. Q1 2018 Benchmark by Location: 6.2-kW Residential System cost (2018 USD/Wdc)⁵



⁴ Fu, Ran, David Feldman, and Robert Margolis, Mike Woodhouse, and Kristen Ardani. 2017. U.S. Solar Photovoltaic System Cost Benchmark: Q1 2017. Golden, CO: National Renewable Energy Laboratory. <https://www.nrel.gov/docs/fy17osti/68925.pdf>

⁵ Fu, Ran, David Feldman, and Robert Margolis. 2018. U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-72399. <https://www.nrel.gov/docs/fy19osti/72399.pdf>.



Incentive Step-Down Analysis: July 2020

As NREL only provides state-specific data for the current reporting year, and does not provide the previous year's data point in inflation-adjusted dollars for California in its current report, this analysis has to be performed manually by examining the 2017 report, which contains 2017 benchmarks in 2017 dollars, and adjusting for inflation to derive a 2017 benchmark in 2018 dollars. To do so, the SOMAH PA applies the same inflation value NREL uses to convert Q1 2017 to Q1 2018 dollars. After doing so, the SOMAH PA calculates the following cost, change, and step-down values. The analysis of California-specific data shows a larger year-over-year cost decrease and thus yields a higher step-down than the analysis of national data.

Benchmark Description (California)	Cost	YoY Change	Step-Down
Q1 2018 Benchmarks in 2018 USD/Wdc	\$2.75		
Q1 2017 Benchmarks in 2017 USD/Wdc	\$2.90	-5.17%	5%
Q1 2017 Benchmarks in 2018 USD/Wdc	\$2.94	-6.46%	5%

Conclusion

The SOMAH PA has concluded in its understanding of [Decision 17-12-022](#) and NREL's two most recent "U.S. Solar Photovoltaic System Cost Benchmark" reports that the program's incentive levels must be reduced by either 4.93% or by 5% in the second program year, spanning July 1, 2020 to June 30, 2021, depending on whether national or CA-specific data are used. Both yield the same table below when rounding to two-decimal places.

Tax Credits		\$ per AC Watt Incentive			
ITC	LIHTC	Tenant		Common	
		2019-2020	2020-2021	2019-2020	2020-2021
No	No	\$3.20	\$3.04	\$1.10	\$1.05
Yes	No	\$2.25	\$2.14	\$0.80	\$0.76
No	Yes	\$2.25	\$2.14	\$0.80	\$0.76
Yes	Yes	\$1.60	\$1.52	\$0.60	\$0.57



Incentive Step-Down Analysis: July 2020

The SOMAH PA also acknowledges that the California Solar and Storage Association, Brightline Defense Project, and Sunrun Inc. submitted a petition for modification of [Decision 17-12-022](#) on May 13, 2020, related specifically to the matter of SOMAH's incentive step-down. We will await the CPUC's direction in taking any action other than what has already been prescribed in the Decision.

Contact Us

Do you have questions or comments on this analysis?

Get in touch with the PA:

- CalSOMAH.org
- 858-244-1177, ext. 5
- Contact@CalSOMAH.org



Incentive Step-Down Analysis: July 2020

Appendix: Additional Reports and Analyses

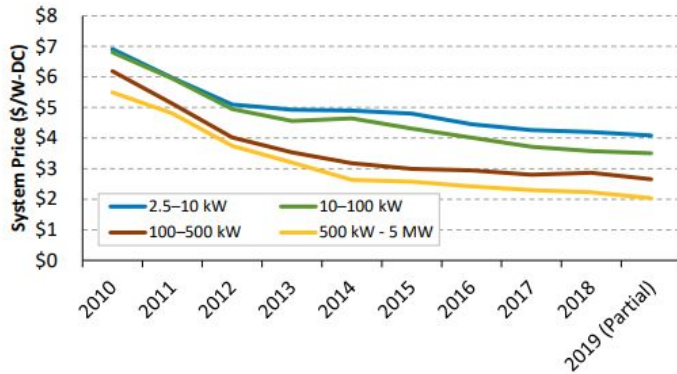
To ensure a comprehensive review of potentially relevant publicly-available reports, the SOMAH PA examined additional work products from NREL and LBNL, namely NREL's Quarterly Solar Industry Update presentation series and LBNL's Tracking the Sun report series. While these work products focus on prices rather than costs -- and the Decision specifies that costs must be examined to determine SOMAH's incentive step-down - these reports generally support that prices are declining within their respective reporting periods.

Quarterly Solar industry Update, NREL

- Reporting period: Q2/Q3 2019
- Price- rather than cost-focused
- Defines customer segments based on kW DC size ranges rather than labels like "residential."
- "Based on partial data, from 2018 to 2019, the median reported PV system price in California, Connecticut, Massachusetts, and New York fell 2% to 9% depending on system size."
 - Based on application data, SOMAH's average system size was a prospective 229 kW AC as of June 5, 2020. Prices for systems in this size range (100-500kW) declined by 7% during the reporting period. See SOMAH's Working Data Set on CalDGStats, updated weekly [here](#), for more details.
 - Prices for the 2.5-10kW customer segment (which we assume are "residential," though NREL doesn't apply that label here) declined by 3% during the reporting period.
- [Landing page. Link to presentation \(PDF\)](#) November 2019.

Incentive Step-Down Analysis: July 2020

System Pricing from Select States



Based on partial data for 2018–2019, the median reported PV system price in California, Connecticut, Massachusetts, and New York fell:

- 3% to \$4.09/W for systems of 2.5 kW–10 kW
- 2% to \$3.51/W for systems of 10 kW–100 kW
- 7% to \$2.65/W for systems of 100 kW–500 kW
- 9% to \$2.04/W for systems of 500 kW–5 MW.

Preliminary 2019 YTD MW: CA (437), CT (35), MA (57), NY (194)
Note: System prices above \$10/W and below \$1/W were removed from the data set.
Sources: CA NEM database (07/31/19); CT Green Bank (09/30/19); MA SREC program (08/19/19); NY SERDA (09/30/19).

NREL | 29

Tracking the Sun, LBNL, September 2018 and October 2019

- Reporting period (2018): All of 2017 and preliminary data for the first half of 2018
- Reporting period (2019): All of 2018 and preliminary trends for the first half of 2019
- Price- rather than cost-focused
- “Over the last full year of the analysis period, national median prices fell by \$0.2/W (5%) for residential, by \$0.2/W (7%) for small non-residential, and by \$0.1/W (5%) for large nonresidential systems. Those \$/W declines are in-line with trends over the past five years.” (Page 2)
- Median installed price in CA for 2018 was \$3.80/2018\$/Wdc
- Median installed price in CA for 2017 was \$3.90/2017\$/Wdc
 - Median installed price in CA for 2017 was \$3.96/2018\$/Wdc (applying same inflation adjustment NREL applies for the 2017-2018 conversion for its data)
 - 2018 prices in CA, adjusting for inflation, were 4% lower.
- [Landing page](#). [Report link \(PDF\)](#) (September 2018). [Report link \(PDF\)](#) (October 2019).

Incentive Step-Down Analysis: July 2020

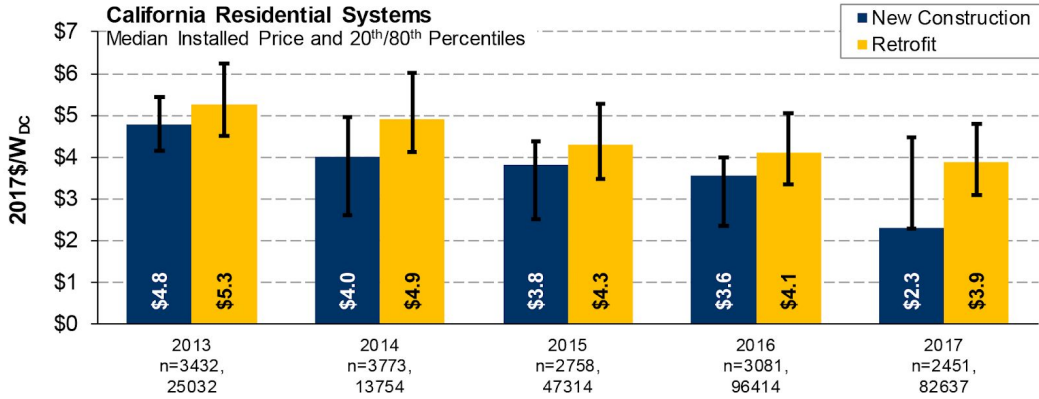


Figure 29. Installed Price of Residential Retrofit vs. New Construction in California

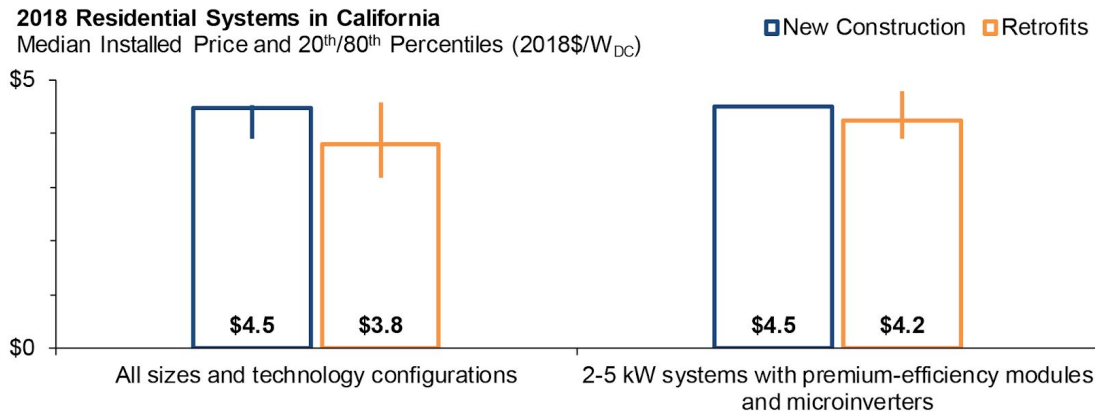


Figure 29. Installed Price of Residential Retrofit vs. New Construction in California