

Residential Solar Energy, Property Values and Real Estate

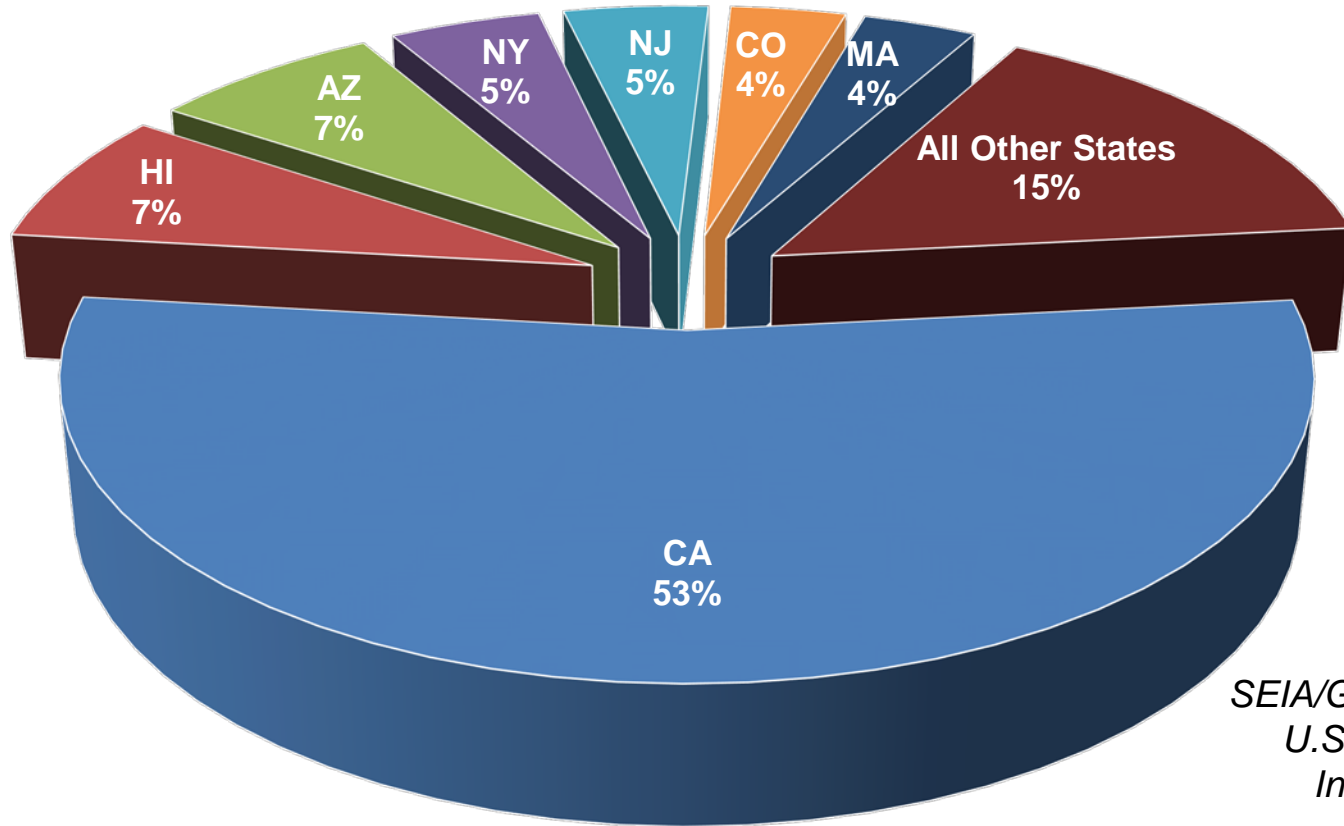
Ben Hoen
Vote Solar
Webinar
Feb 24, 2016



Agenda

- **Background:** Why Is This Important?
- **Previous Literature:** What Needs To Be Studied?
- **LBNL Research:** What Are The Multiple LBNL Efforts In This Area?
- **Other News:** What's Next?

725,000 US Residential Installations Through Q2 2015

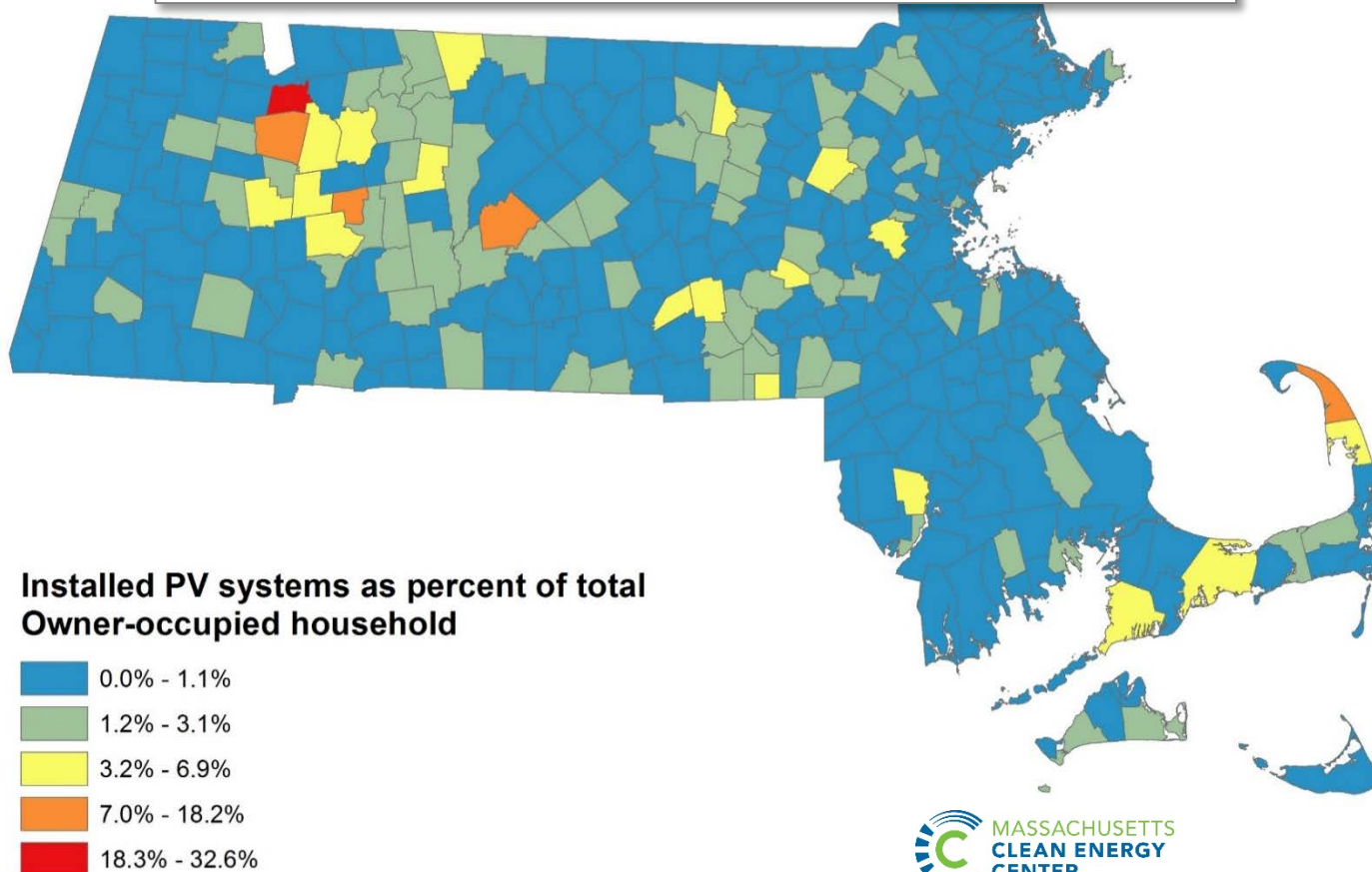


Source:
SEIA/GTM Research
U.S. Solar Market
Insight Q2 2015

- Residential Total = 4.4 GW (~0.13% generation)
- 725,000 = < 1% of US Housing Stock

In Some Locations 10-20% Of The Homes Have Solar

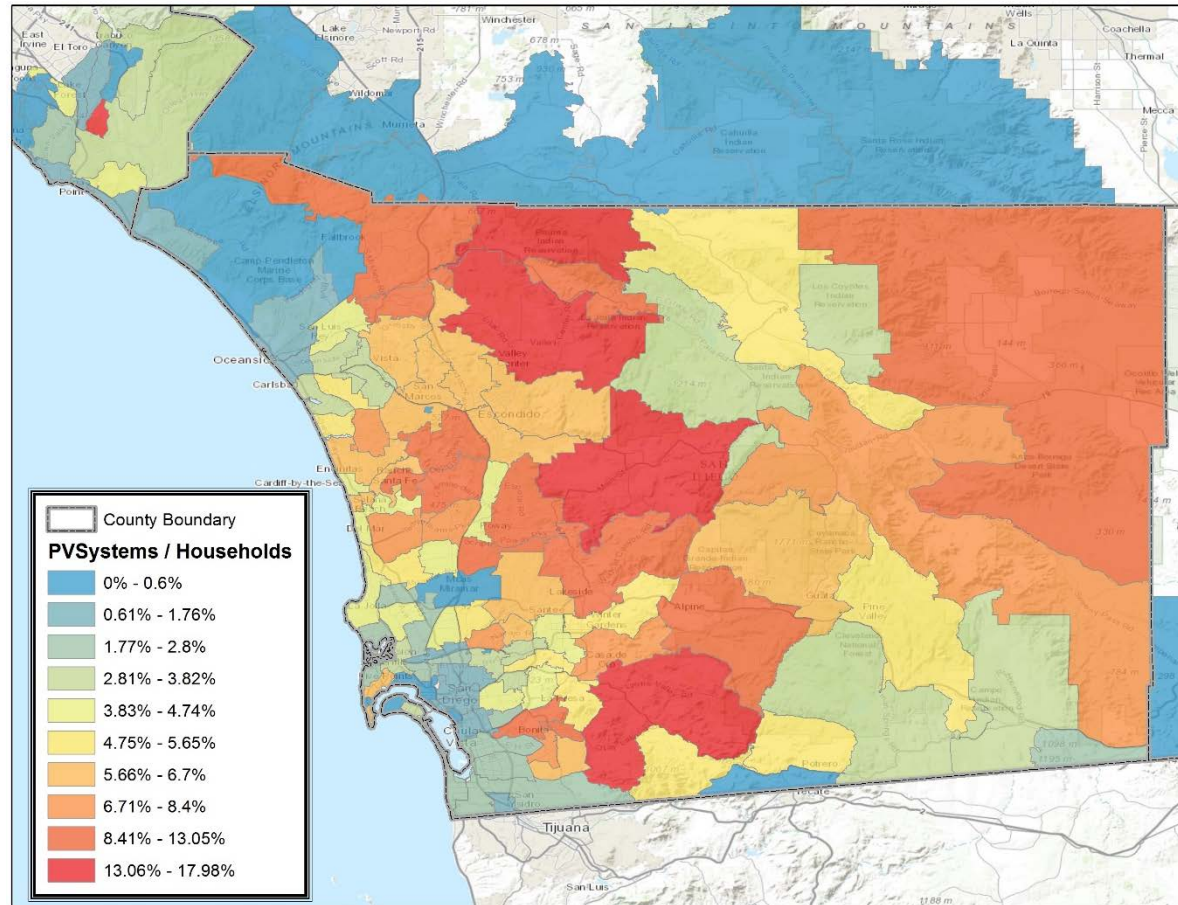
Example From Massachusetts



Source: Massachusetts Clean Energy Center Production Tracking System

In Some Locations 10-20% Of The Homes Have Solar

Example From San Diego



source data - https://www.californiasolarstatistics.ca.gov/data_downloads/

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But What About The Value Of These Homes?



Host-Owned PV Systems Have Been Shown to Command a Price Premium in the Marketplace

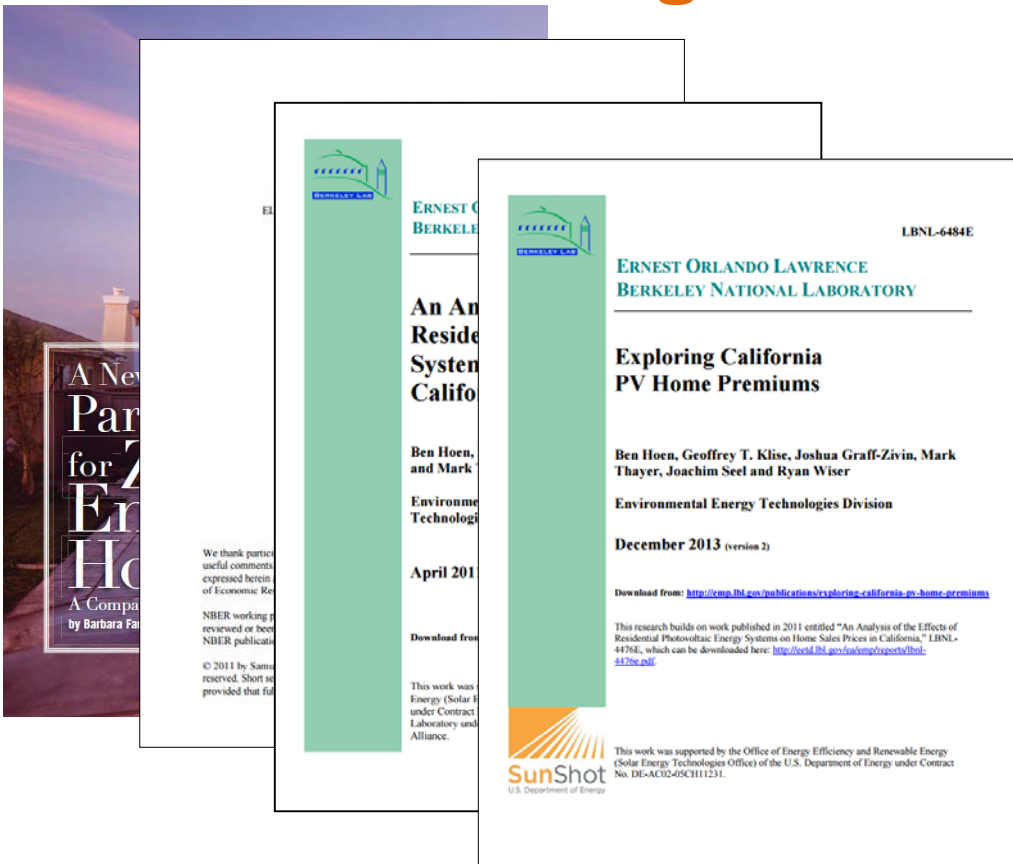
Based on Large Scale Statistical Studies

*Farhar & Coburn, 2008;
Dastrup et al., 2011;
Hoen et al., 2011; 2012*

All Conducted in California

And Small Scale Appraiser Studies

*Desmarais, 2013 (Colorado);
Watkins, 2011 (Oregon)*



Having Expanded Valuation Methods Accepted By Practitioners and Institutions Is Needed

Comparing
PV to non-PV
Homes

Sales
Comparison
Approach

Vs.

Income
Approach

&

Cost
Approach

“Market Value”

**Income Approach
using PV Value®:**

Present value of stream
of energy cost savings

Cost Approach:

Installed costs of PV
systems at time of sale:
“Gross” or “Net” (less
federal, state and utility
incentives)

**Residential Valuations Have Classically
Relied On Sales Comparison**

Institutional Support Exists Recognizing Solar's Value And Encouraging Its Appraisal



Selling Guide

Fannie Mae Single Family

Published December 16, 2014

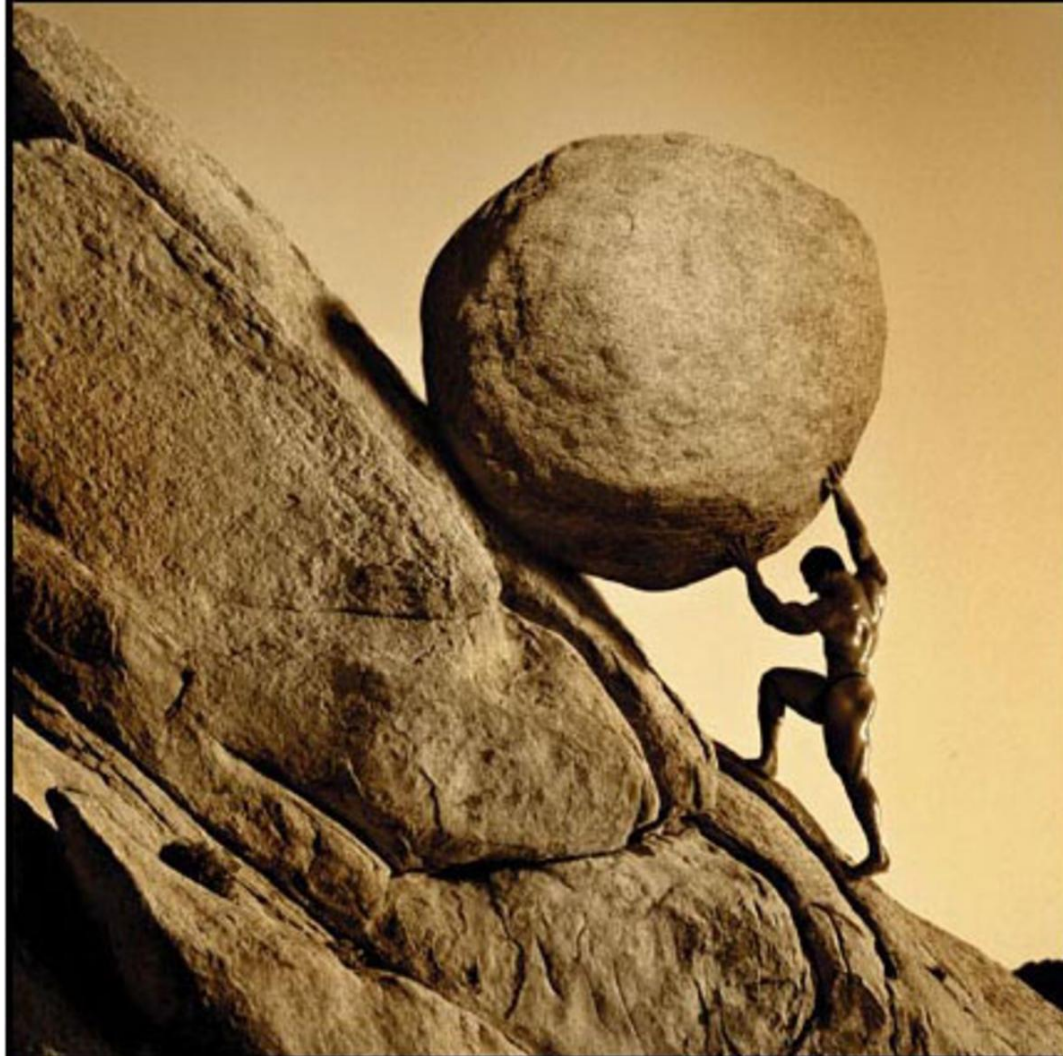
FHA Single Family Housing Policy Handbook Table of Contents

1	FHA Single Family Housing Policy Handbook	
2	TABLE OF CONTENTS	
3	II. FHA SINGLE FAMILY INSURED HOUSING PROGRAMS	1
4	B. TITLE II FORWARD MORTGAGES.....	1
5	1. Origination Through Post-Closing/Endorsement	1
6	a. INTRODUCTION	1
7	b. ORIGINATION/PROCESSING	2
8	i. Applications and Disclosures	2
9	(A) Contents of the Mortgage Application Package	2
10	(1) General Requirements	2
11	(a) Maximum Age of Mortgage Application Documents	2
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13	(ii) Appraisal Validity	2
14	(b) Handling of Documents	3
15	(i) Information Sent to the Mortgagee Electronically	3
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21	(2) Mortgage Application and Initial Supporting Documentation	5
22	(a) URLA and Addendum to the URLA	5
23	(b) Mortgage Application Name Requirements	5
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25	(ii) Documentation	6
26	(3) Borrower Authorization for Verification Information	6
27	(a) Borrower's Authorization	6
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36	(a) Sales Contract	7
37	(i) Standard	7
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39	(b) Statement of Appraised Value	8
40	(B) Disclosures and legal compliance	9
41	(1) HUD Required Disclosures	9
42	(a) Informed Consumer Choice Disclosure	9
43	(b) Form HUD-92900-B, Important Notice to Homebuyers	9

November 5, 2013

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Prior To 2015, There Were Still Significant Limitations To The Literature

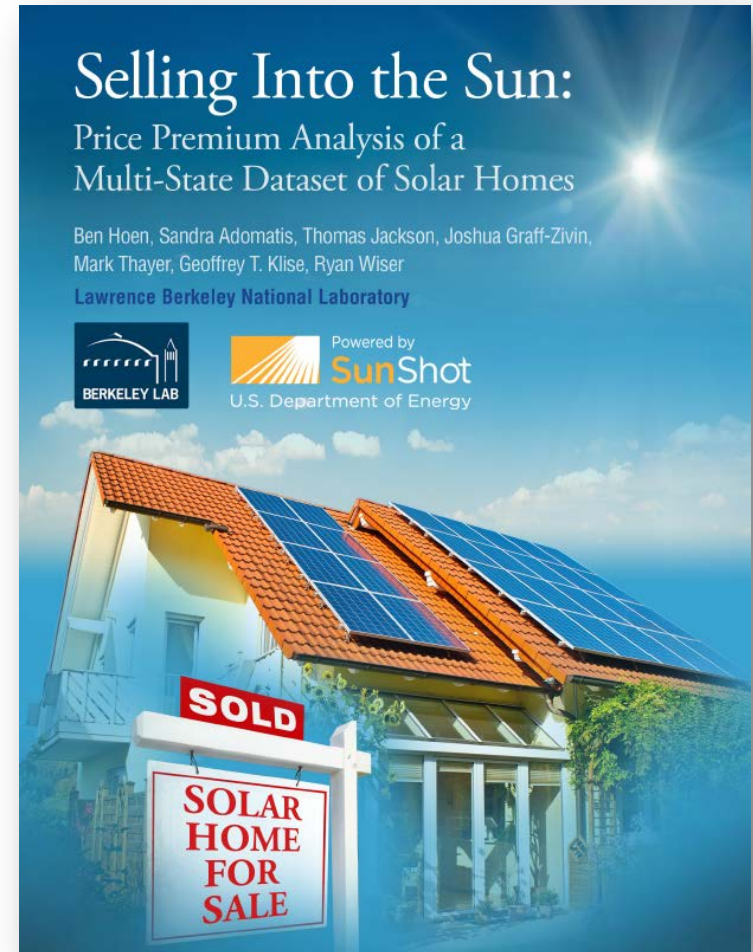


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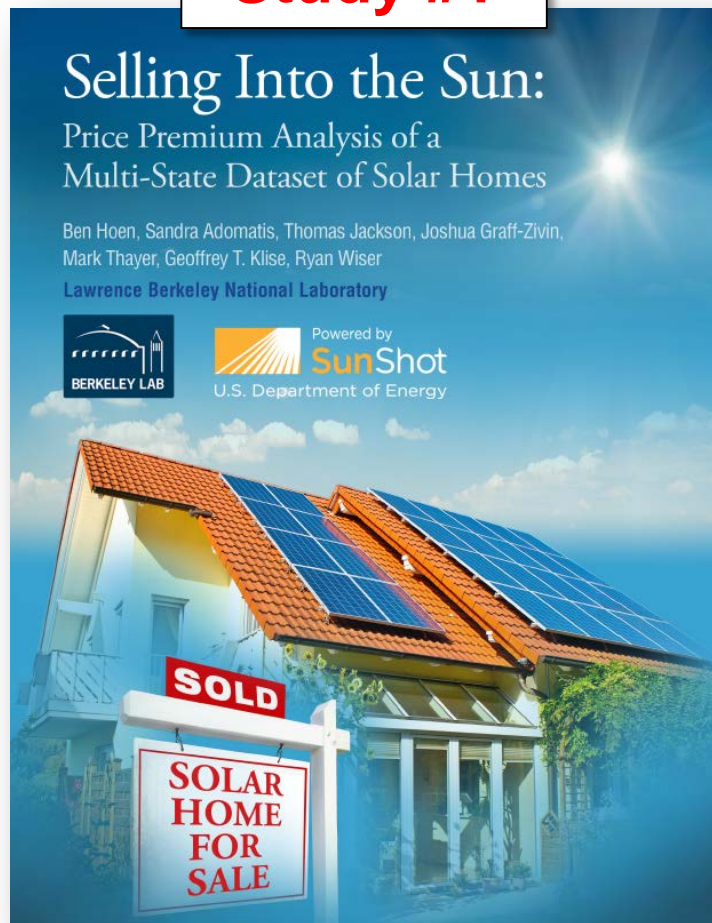
LBNL Conducted/Is Conducting Multiple Research Efforts To Fill Gaps

1. **Selling Into The Sun:** Price Premium Analysis of a Multi-State Dataset of Solar Homes
(2015; See Right)
2. **Appraising Into The Sun:** Small Scale Analyses (SSAs) using Appraisal Techniques of Host Owned Systems in Six States (2015)
3. **Survey of San Diego Buyers/Sellers/Realtors** involved in TPO transactions (2016)
4. **Statistical & SSA TPO:** Statistical Analysis and Appraisals of Leased Systems in CA (Ongoing)
5. **PV Auto-Pop Roadmap:** Plan for implementing auto-population of solar system characteristics into real estate multiple listing services (Ongoing)



2015 Study Examined Largest Dataset Of Host-Owned PV Home Transactions Assembled To-Date

Study #1



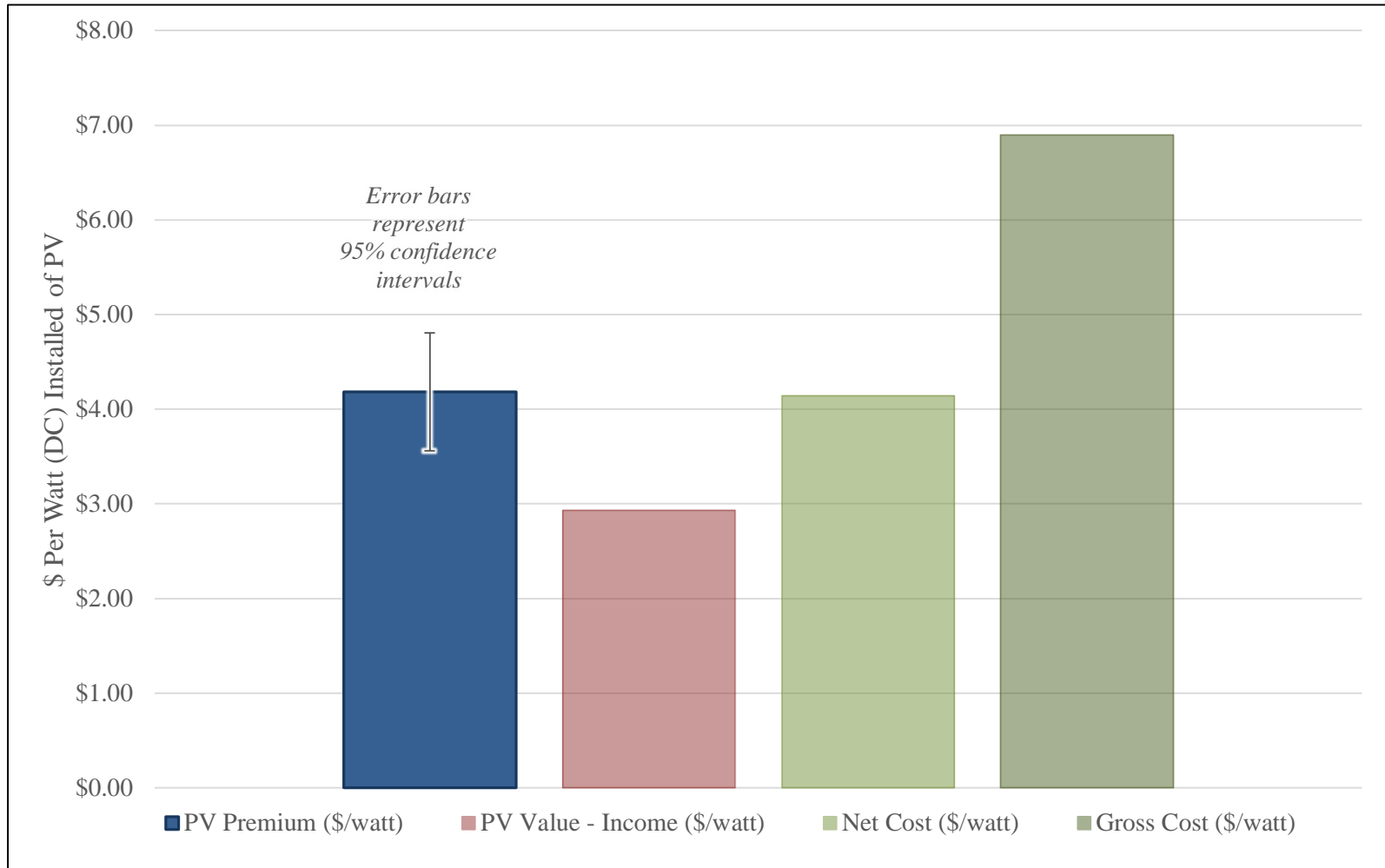
Total 22,822 Homes

- 3,951 PV
- 18,871 Non-PV

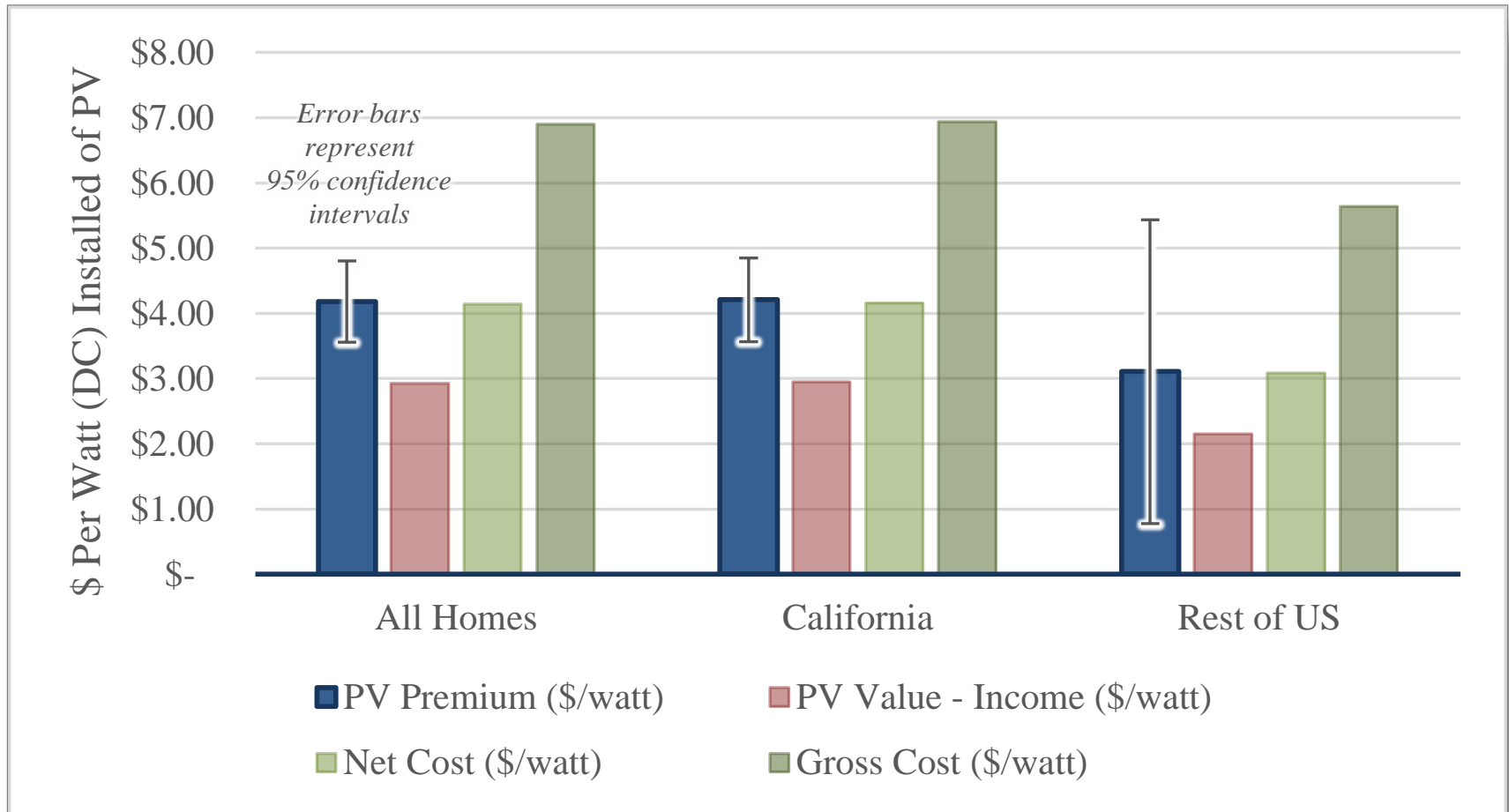
Spanning 12 years and 8 states

Sale Year	Non-PV Homes	PV Homes	Total
2002	107	18	125
2003	196	31	227
2004	238	53	291
2005	197	56	253
2006	348	64	412
2007	818	242	1,060
2008	1,251	453	1,704
2009	1,762	429	2,191
2010	2,751	504	3,255
2011	3,341	642	3,983
2012	3,928	694	4,622
2013	3,934	765	4,699
Total	18,871	3,951	22,822

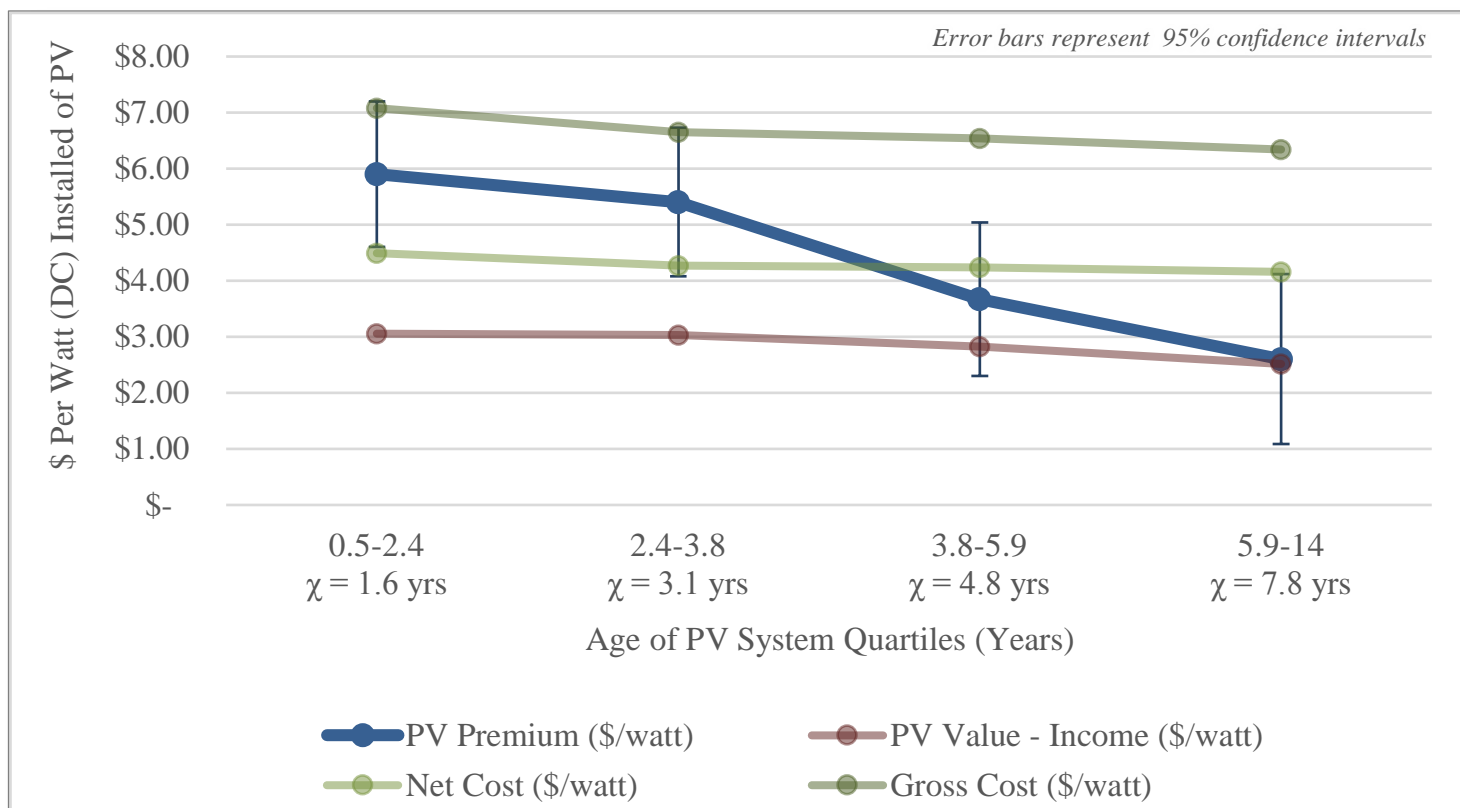
What Did We Find?



We Find Similar Relationships In California And In The Rest Of The US



There Is A Clear Decrease In Price For Older Systems



**There is less clarity as systems age
into their second decade**

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Appraisers Examined Dataset Of Host-Owned PV Home Transactions Across Multiple States

Study #2



- Completed late 2015
- Involved 7 appraisers
- Covered sales in 6 states
- Used sales analyzed in “Selling Into The Sun”
- Used a paired-sales technique
- Focused on **Host-Owned Systems**

Meet The Appraisers

Sarah S. Houston, Oregon CRA & Accredited Green Appraiser (AGA)
Sam Houston Appraisers

Jay Kimmel, SRA, Kimmel Appraisal Group
Kimmel Appraisal Group

Joel G. Tate, SRA, RAA
Tate & Company Inc.

Taylor Watkins
Watkins & Associates

Lynn A. Dordahl, MBA
31915 Rancho California Road, Suite 200, Temecula, CA 92591

John F. Szymanski
John F Szymanski, Appraisers

Sandy Adomatis
Adomatis Appraisal Services

Many Transactions Were Not Usable For Paired Sales Analysis

We Gave Appraisers 208 PV “Most Recent” Sales Across Their Markets

~~No Pair Could Be Found~~

~~Not in MLS~~ ~~80%~~ ~~Foreclosure~~



Final Dataset: 43 PV Sales In 6 States

State	Market	Final Set of Paired Solar Home Sales
CA	San Diego Metro Area	13
FL	Gulf Coast	4
MD	Baltimore Metro Area	3
NC	Raleigh Metro Area	7
OR	Portland Metro Area	9
OR	Bend Metro Area	2
PA	Southeast Portion	5
Total		43

A Paired Sales Analysis Was Conducted On Each Transaction

Six State Study of Solar PV Sales Price Premiums

Paired Sale #34 - 3222 NE 51st Ave.

Features	3222 NE 51st Ave. 97213	3215 NE 45th Ave. 97213	Adjustment
MLS/Tax ID/Source	12214668	12158180	
Date of Sale	7/2/2012	7/11/2012	0
Sale Price	\$467,900		\$452,000
\$/SF of Living Area	330.4	294	
SF of Living Area	1416	1538	-6100
Lot Size	5000	5000	
Site/View	--	--	
House Style	1 1/2 story	1 1/2 story	
Number of Stories	--	--	
Actual Age - Eff Age	83	87	
Condition	Good	Good	
Room Count -Total Bedroom-Bathroom	7/3/2	7/3/2	
Basement Sq. Ft.	750	896	
Finished Basement Sq. Ft.	750	0	9100
Heat/Air Conditioning	FA/None	FA/None	
Garage -# Cars	2	1	6000
Amenities/porches/patio/	Por/Dk	Por/Dk	
Pool - tennis cts	--	--	
Solar PV-Size-Age	2.94kW - 1.5		
Other -outbuildings			
Other	1FP	1FP	
Adjusted Sales Price	\$467,900		\$461,000
Indicated Price/Watt	\$6,900 or \$2.35 per Watt		
Gross Cost/Watt	\$5.46/Watt		
Net Cost/Watt	\$1.83/Watt		

Reconcile: (Provide brief summary of paired analysis)

These properties are extremely similar in design, build quality, size, condition, and location.

Cost Approach: Solar PV System Cost - \$___5.46___ \$/Watt (Cost New as of the date of sale) \$16,052

Source for cost: Neil Kelly/Mr. Sun Solar, Energy Trust of Oregon

Incentives or rebates available as of that date if known:

Source for cost: Solar Oregon and Energy Trust of Oregon

Incentives or rebates available as of that date if known:

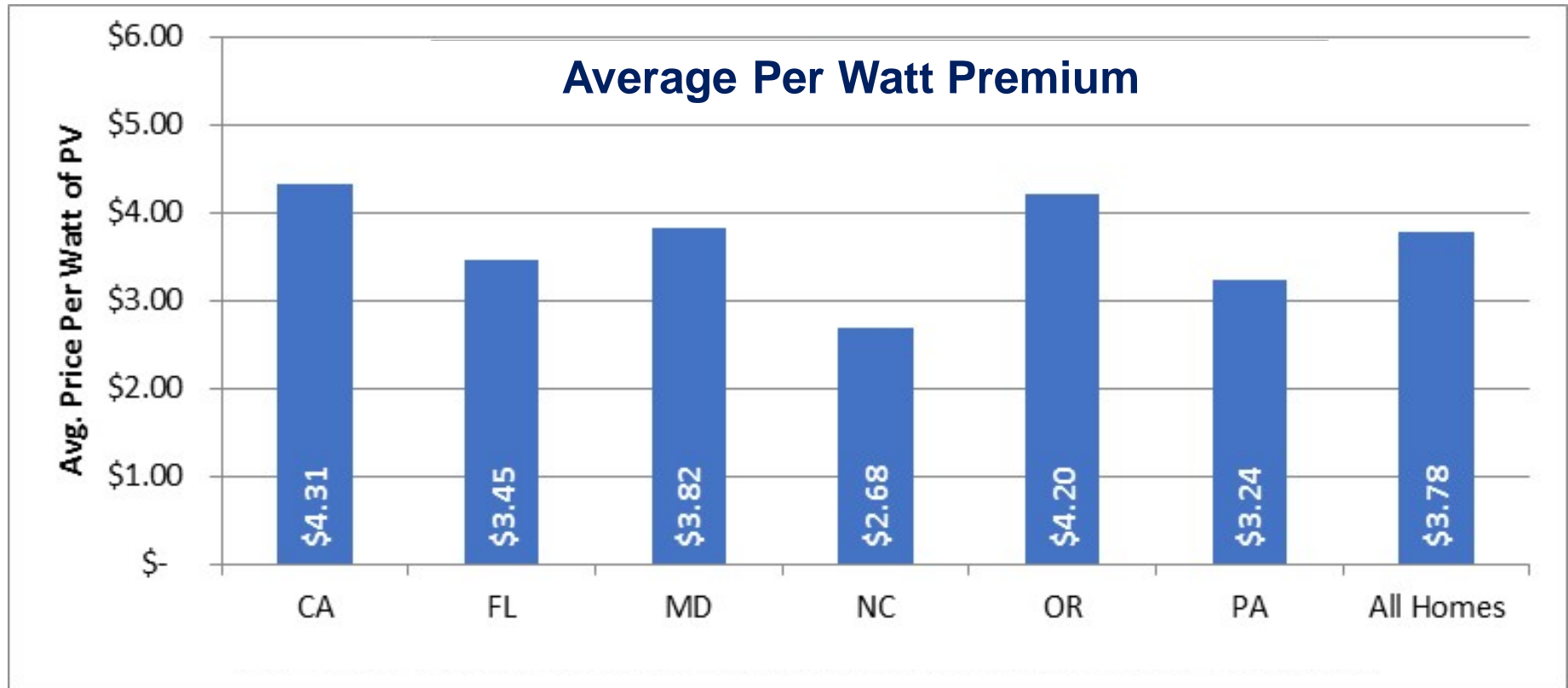
30% Federal (minus utility incentive ((ETO incentive)) - \$3,977

Oregon State (\$1.90/ watt up to \$6,000) \$5,586

Energy Trust Incentive \$0.95/watt - 2,793

Total Cost \$5,371+/- (not all state credits taken before sale)

Premiums Are Clearly Evident Across All States

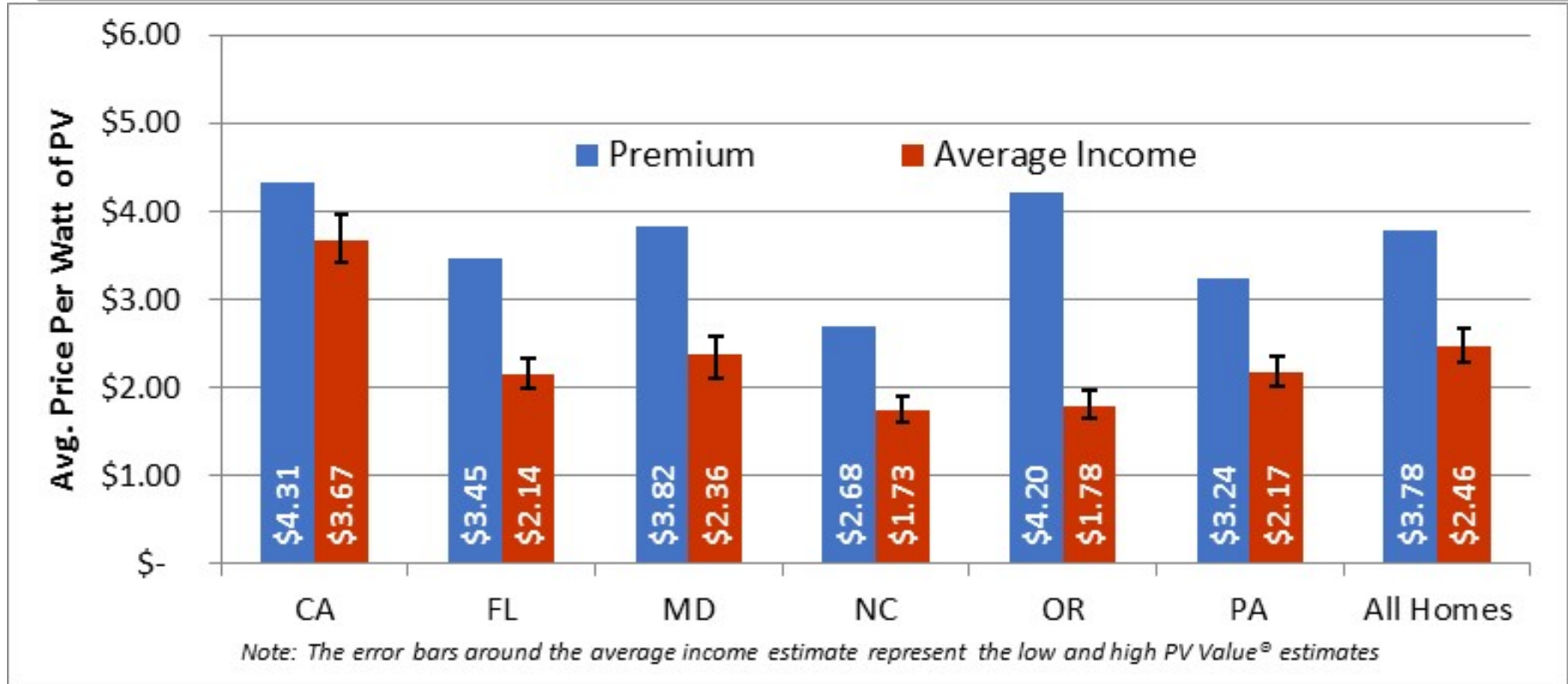


Note: Premiums apply to average 2012 sales. Sales today, and in other markets, would be based on their respective market characteristics.

correlation of premium (in \$) to size (in watts): 0.54 (p-value 0.000)

Premiums Are Higher Than Income Estimates (Especially OR)

Income Could Be Considered Conservative

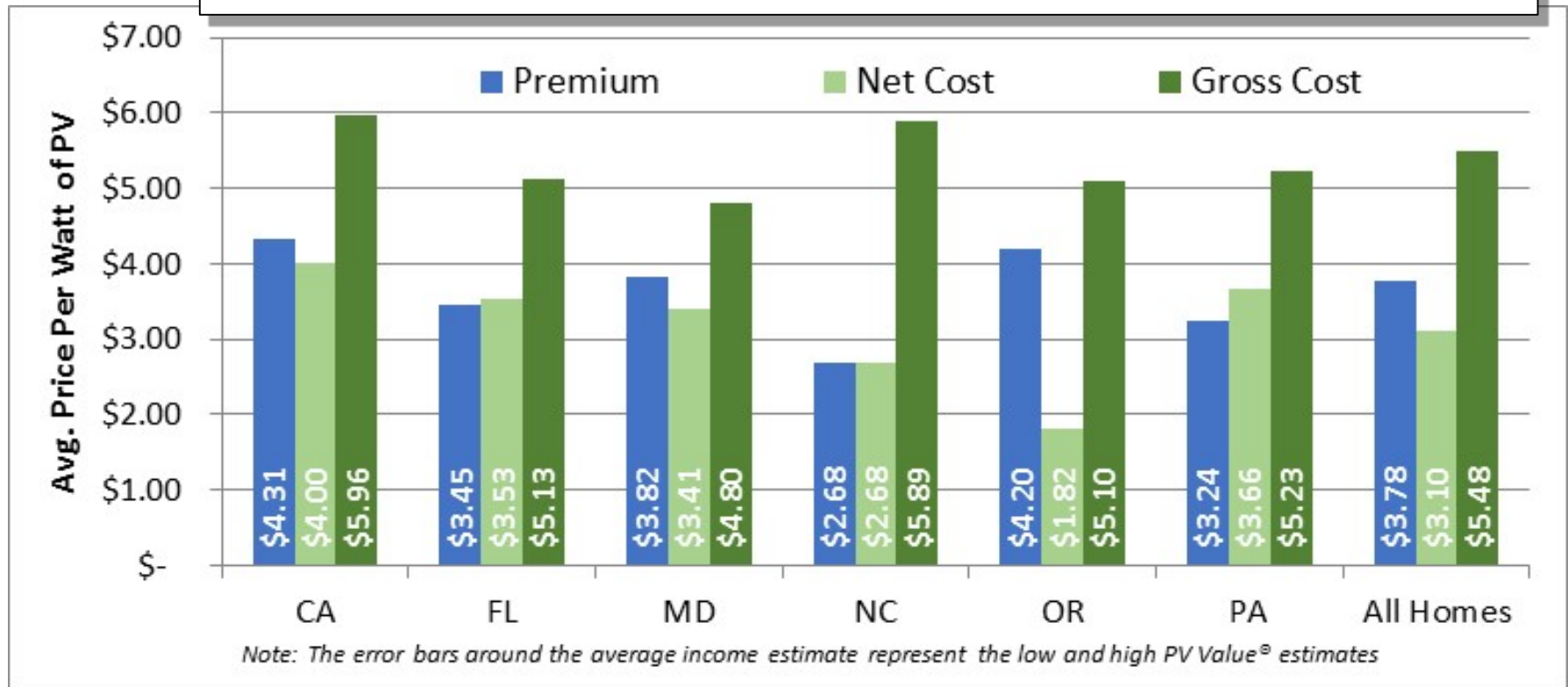


premium to income correlation: All cases 0.20 (p 0.18); No OR 0.38 (p 0.03)

t-Test: All cases 1.23 (p 0.00); No OR 0.82 (p 0.00)

Premiums Are Most Similar To Net Cost Estimates (But Not OR)

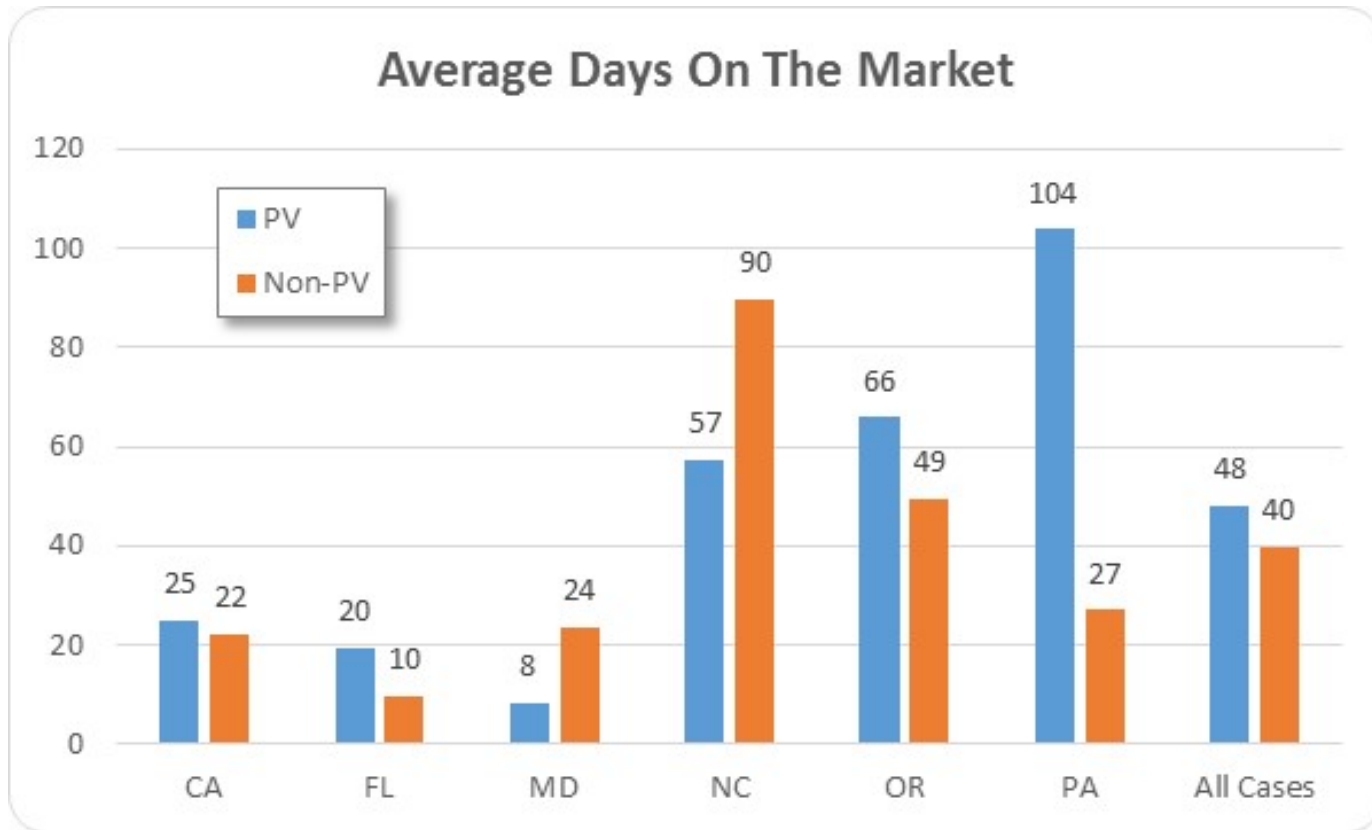
And Not Similar To Gross Cost



Premium & Net t-Test: All cases 0.65 (p 0.05); No OR 0.09 (p 0.75)
Premium & Gross t-Test: All cases -1.72 (p 0.00); No OR 1.98 (p 0.00)

Average Days On The Market Are Not Different For These PV Homes

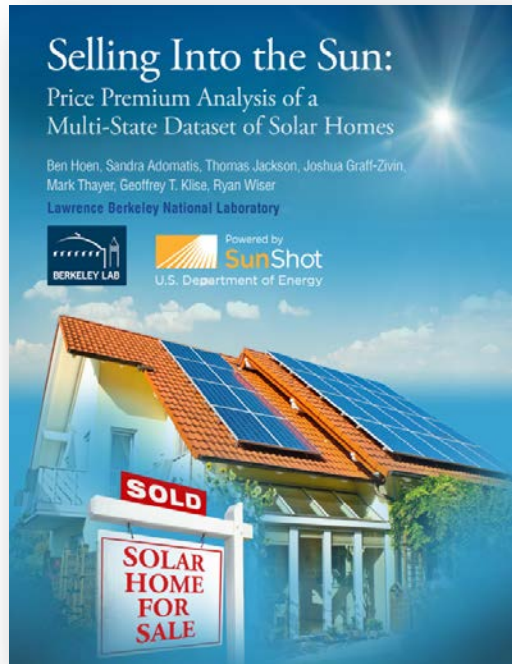
In Some States PV Homes Sell Slower, In Others Faster



t-Test: All cases -3.72 days (p 0.76)

Comparison Of Methods

Hedonic Pricing Model Vs. Paired Sales



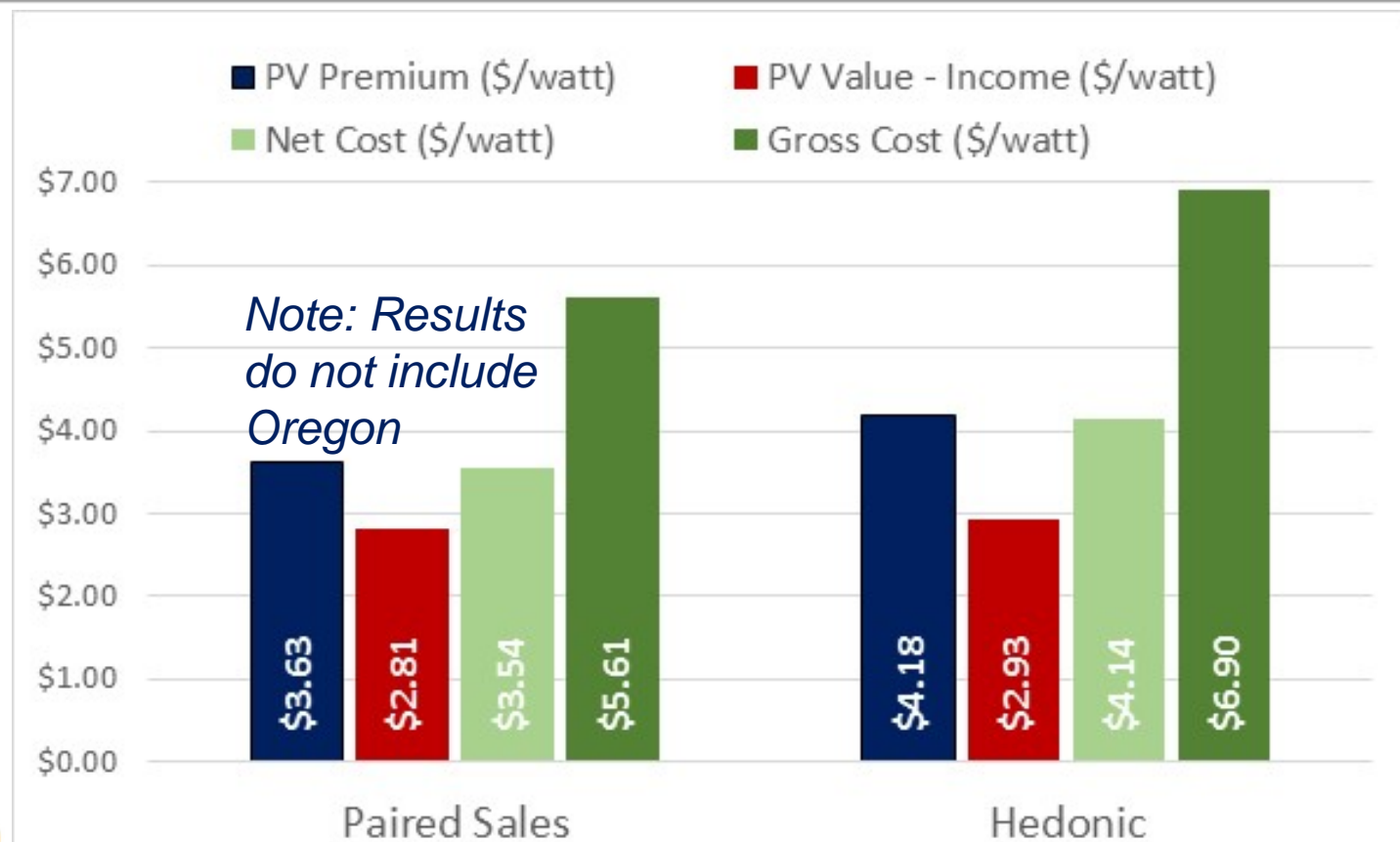
Vs.



- Overlapping datasets but different methodologies
- Similar approaches: premiums vs income/cost

Both Studies Tell A Similar Story: Premiums Are Clearly Evident

And Premiums Are Most Similar to Net Cost,
Somewhat Similar To Income, And Not To Gross Cost



Analysis Conclusions – Host Owned

- PV consistently adds value, regardless of approach and sub-sample.
- PV's value should be considered in transactions
- PV systems buyers can have greater confidence that systems should retain value well into the first decade
- But actual values will depend on individual markets, retail rates, installed costs, incentives, etc.
- Practitioners have multiple approaches and tools to value solar
- Net Cost Estimates should be used if divergent from Gross Costs
- Institutional changes are happening but much more needs to happen
 - PV system characteristics in MLS
 - Leased systems should be statistically studied
 - Commercial valuation of Solar should be investigated

Outreach

pV magazine
PHOTOVOLTAIC MARKETS & TECHNOLOGY

The
Washington
Post



The Boston Globe

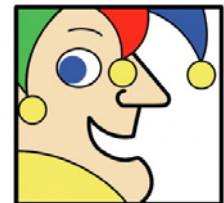
The New York Times



greentechmedia:

Seeking Alpha α

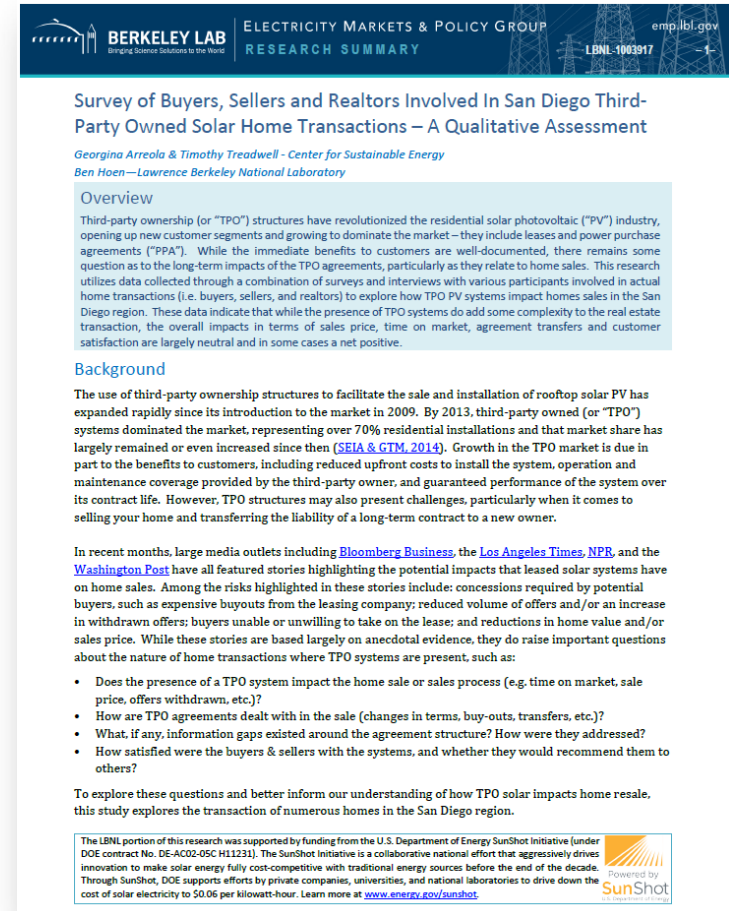
SCIENTIFIC
AMERICAN



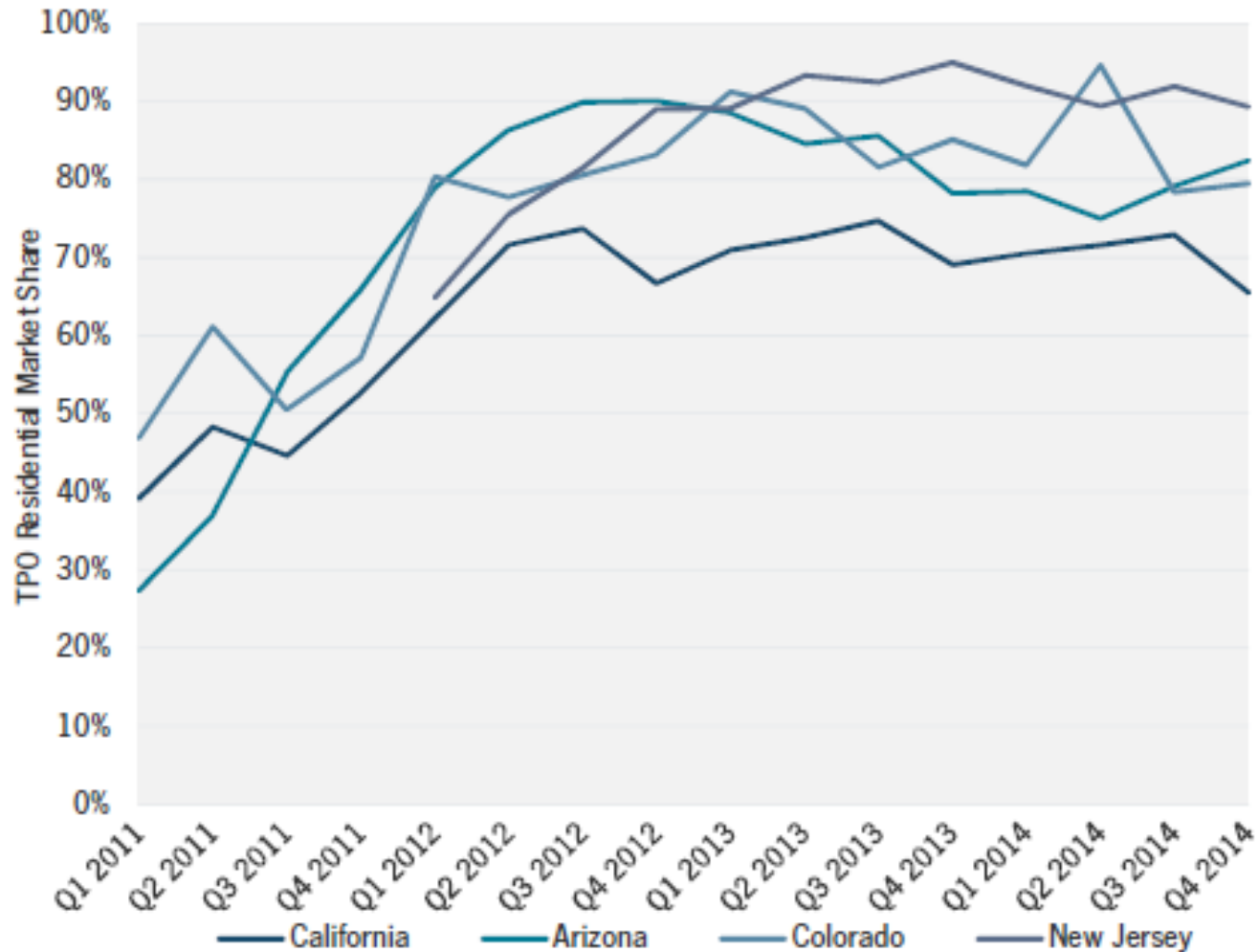
The Motley Fool

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Why TPO Systems?



Source: SEIA/GTM Research U.S. Solar Market Insight 2014

Homes With TPO Systems Have Been In The News



Leased Solar Panels Can Cast A
Shadow Over A Home's Value

Jul 15, 2014

Rooftop Solar Leases Scaring
Buyers When Homeowners Sell

Jun 24, 2014

**Bloomberg
Business**

Los Angeles Times

Leased solar panels can
complicate - or kill - a home sale

Mar 22, 2015

Survey Of Buyers, Sellers and Realtors of Homes With TPO Systems



Survey of Buyers, Sellers and Realtors Involved In San Diego Third-Party Owned Solar Home Transactions – A Qualitative Assessment

Georgina Arreola & Timothy Treadwell - Center for Sustainable Energy
Ben Hoen—Lawrence Berkeley National Laboratory

Overview

Third-party ownership (or “TPO”) structures have revolutionized the residential solar photovoltaic (“PV”) industry, opening up new customer segments and growing to dominate the market—they include leases and power purchase agreements (“PPA”). While the immediate benefits to customers are well-documented, there remains some question as to the long-term impacts of the TPO agreements, particularly as they relate to home sales. This research utilizes data collected through a combination of surveys and interviews with various participants involved in actual home transactions (i.e. buyers, sellers, and realtors) to explore how TPO PV systems impact homes sales in the San Diego region. These data indicate that while the presence of TPO systems do add some complexity to the real estate transaction, the overall impacts in terms of sales price, time on market, agreement transfers and customer satisfaction are largely neutral and in some cases a net positive.

Background

The use of third-party ownership structures to facilitate the sale and installation of rooftop solar PV has expanded rapidly since its introduction to the market in 2009. By 2013, third-party owned (or “TPO”) systems dominated the market, representing over 70% residential installations and that market share has largely remained or even increased since then (SEIA & GTM, 2014). Growth in the TPO market is due in part to the benefits to customers, including reduced upfront costs to install the system, operation and maintenance coverage provided by the third-party owner, and guaranteed performance of the system over its contract life. However, TPO structures may also present challenges, particularly when it comes to selling your home and transferring the liability of a long-term contract to a new owner.

In recent months, large media outlets including [Bloomberg Business](#), the [Los Angeles Times](#), [NPR](#), and the [Washington Post](#) have all featured stories highlighting the potential impacts that leased solar systems have on home sales. Among the risks highlighted in these stories include: concessions required by potential buyers, such as expensive buyouts from the leasing company; reduced volume of offers and/or an increase in withdrawn offers; buyers unable or unwilling to take on the lease; and reductions in home value and/or sales price. While these stories are based largely on anecdotal evidence, they do raise important questions about the nature of home transactions where TPO systems are present, such as:

- Does the presence of a TPO system impact the home sale or sales process (e.g. time on market, sale price, offers withdrawn, etc.)?
- How are TPO agreements dealt with in the sale (changes in terms, buy-outs, transfers, etc.)?
- What, if any, information gaps existed around the agreement structure? How were they addressed?
- How satisfied were the buyers & sellers with the systems, and whether they would recommend them to others?

To explore these questions and better inform our understanding of how TPO solar impacts home resale, this study explores the transaction of numerous homes in the San Diego region.

The LBNL portion of this research was supported by funding from the U.S. Department of Energy SunShot Initiative (under DOE contract No. DE-AC02-05C H11231). The SunShot Initiative is a collaborative national effort that aggressively drives innovation to make solar energy fully cost-competitive with traditional energy sources before the end of the decade. Through SunShot, DOE supports efforts by private companies, universities, and national laboratories to drive down the cost of solar electricity to \$0.06 per kilowatt-hour. Learn more at www.energy.gov/sunshot.



Sales from 2010 through 2013 44 Responses In Total

Audience	Instrument	Invites/calls received	Total Responses	Response Rate
Realtors	Semi-structured phone interview	49	15	31%
Sellers	Online survey; email invite	77	11	14%
Buyers	Online survey; mail invite	113	18	16%

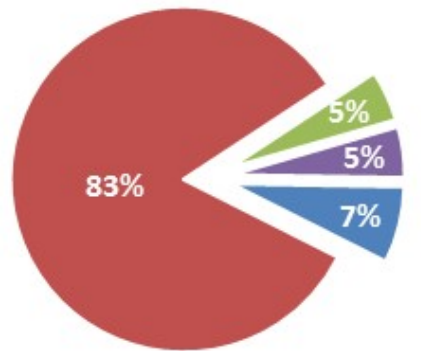
In collaboration with



Mixed Reactions To TPO Systems

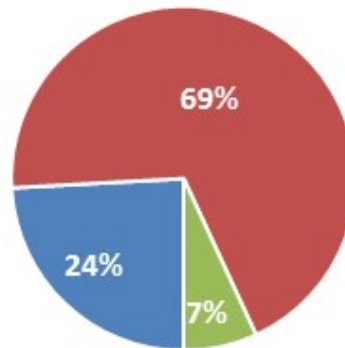
- 77% leases transferred, 23% bought out

Perceived Premium



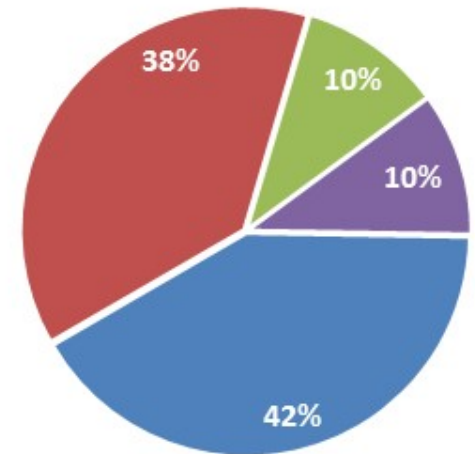
■ loss ■ no premium
■ premium ■ unknown

Perceived Time On Market Change



■ longer ■ same ■ shortened

Would You Do It Again?



■ yes ■ maybe ■ no ■ unknown

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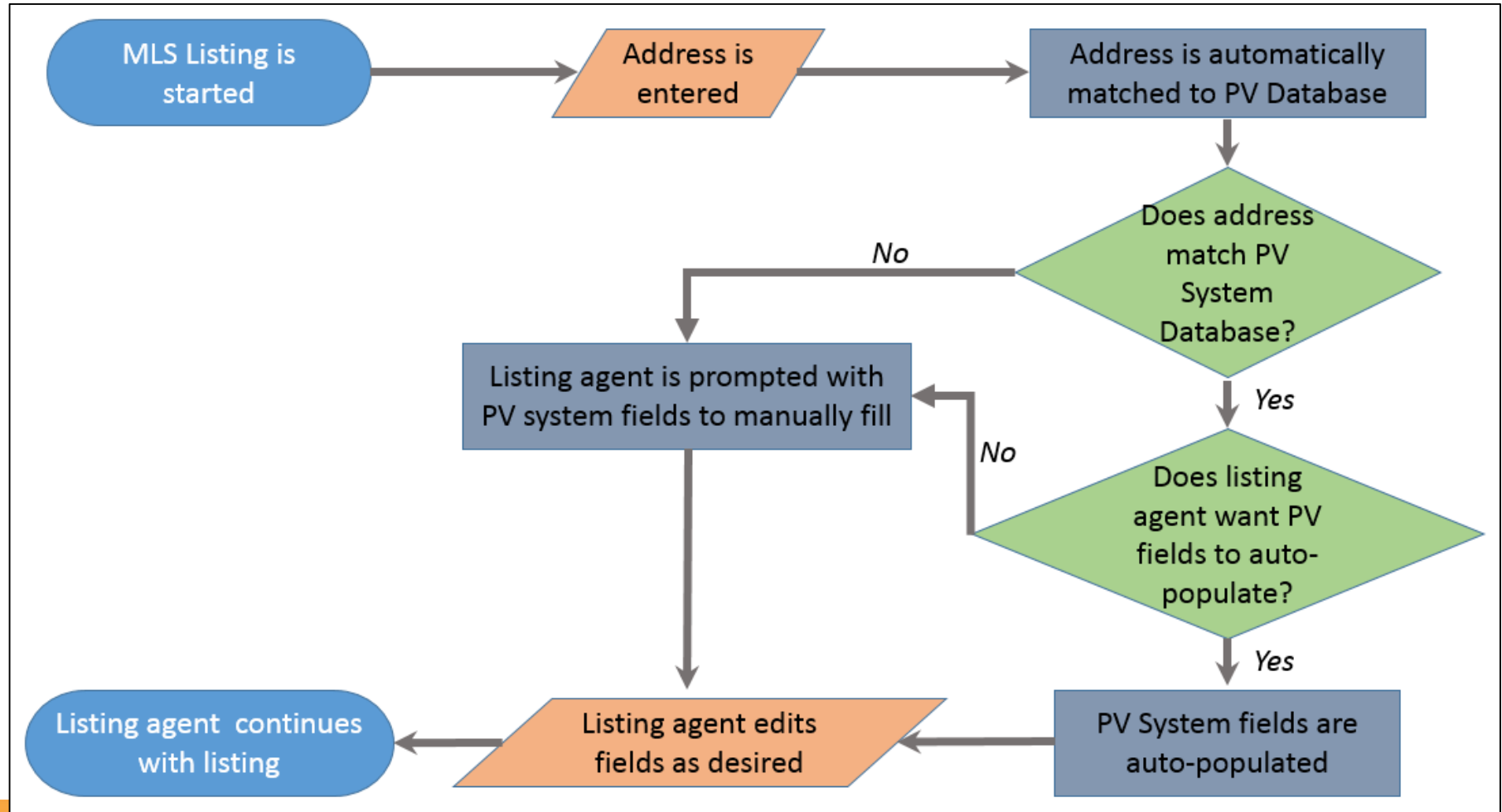


Statistical and Small Scale Analysis of TPO Transactions

- Analyze a ~500 transactions of homes with TPO PV systems in CA
- Appraiser led analysis of small sample of TPO transactions
- Analysis of lease/PPAs involved in TPO transactions

PV Auto-Pop Roadmap Project:

Plan For How To Auto-Pop PV Data (Like Tax Data)





Thank You



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Links

[*Selling Into The Sun*](#)

[*Appraising Into The Sun*](#)

[*TPO Buyer/Seller/Realtor Survey*](#)

[*LBNL Renewable Energy Publications*](#)

[*PV Value®*](#)

References

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