LBNL Report Release Webinar

Sandra Adomatis

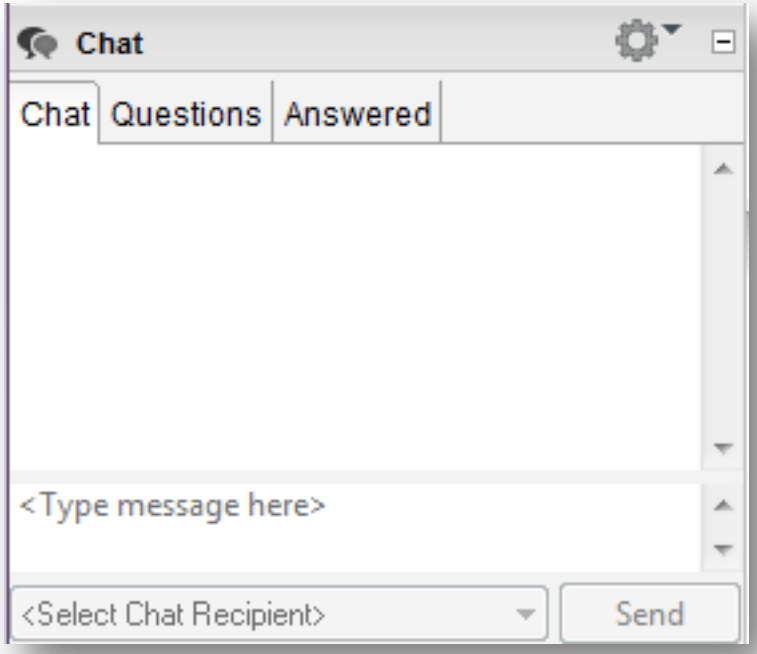
Ben Hoen

November 12, 2015

This work was supported by the Office of Energy Efficiency and Renewable Energy (Solar Energy Technologies Office) of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231

Webinar Questions

- Because of the large number of registrants for today's webinar, questions will be handled via the chat window after the presentation is complete.
- They will be answered in the order they are received.
- If there is not time to answer all of the questions during the 1-hour webinar, they will be answered via email.



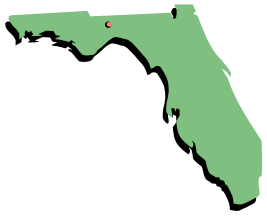
Agenda

- **Meet The Authors & Appraisers**
- **Background:** Why Is This Important?
- **Previous Literature:** What Needs To Be Studied?
- **LBNL Research:** Appraising Into The Sun Results?
- **Conclusions:** What Do We Know Now?
- **Upcoming LBNL Research:** What Do We Do Next?

Sandra K. Adomatis, SRA, LEED Green Associate

Adomatis Appraisal Service

- Author
- Real Estate Appraiser – SRA Designation with Appraisal Institute
- REALTOR
- Appraisal Institute Instructor
- LEED Green Associate – U.S. Green Building Council
- National Speaker on High Performance Houses
- Co-Author of “Selling Into The Sun”



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Ben Hoen
Staff Research Associate

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Bringing Science Solutions to the World

ELECTRICITY MARKETS & POLICY GROUP

emp.lbl.gov

- Researcher at Berkeley Lab, a primarily DOE funded research lab
- Work focuses on renewable energy and public acceptance
- Lead author of landmark 2009 study investigating PV home premiums
- Work has appeared in leading economic and real estate journals
- Quoted in Wall Street Journal, Boston Globe, NPR, Bloomberg News, NBC
- Degrees in Finance, Business and Environmental Policy
- Lead Author of “Selling Into The Sun”

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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

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John F. Szymanski
John F Szymanski, Appraisers

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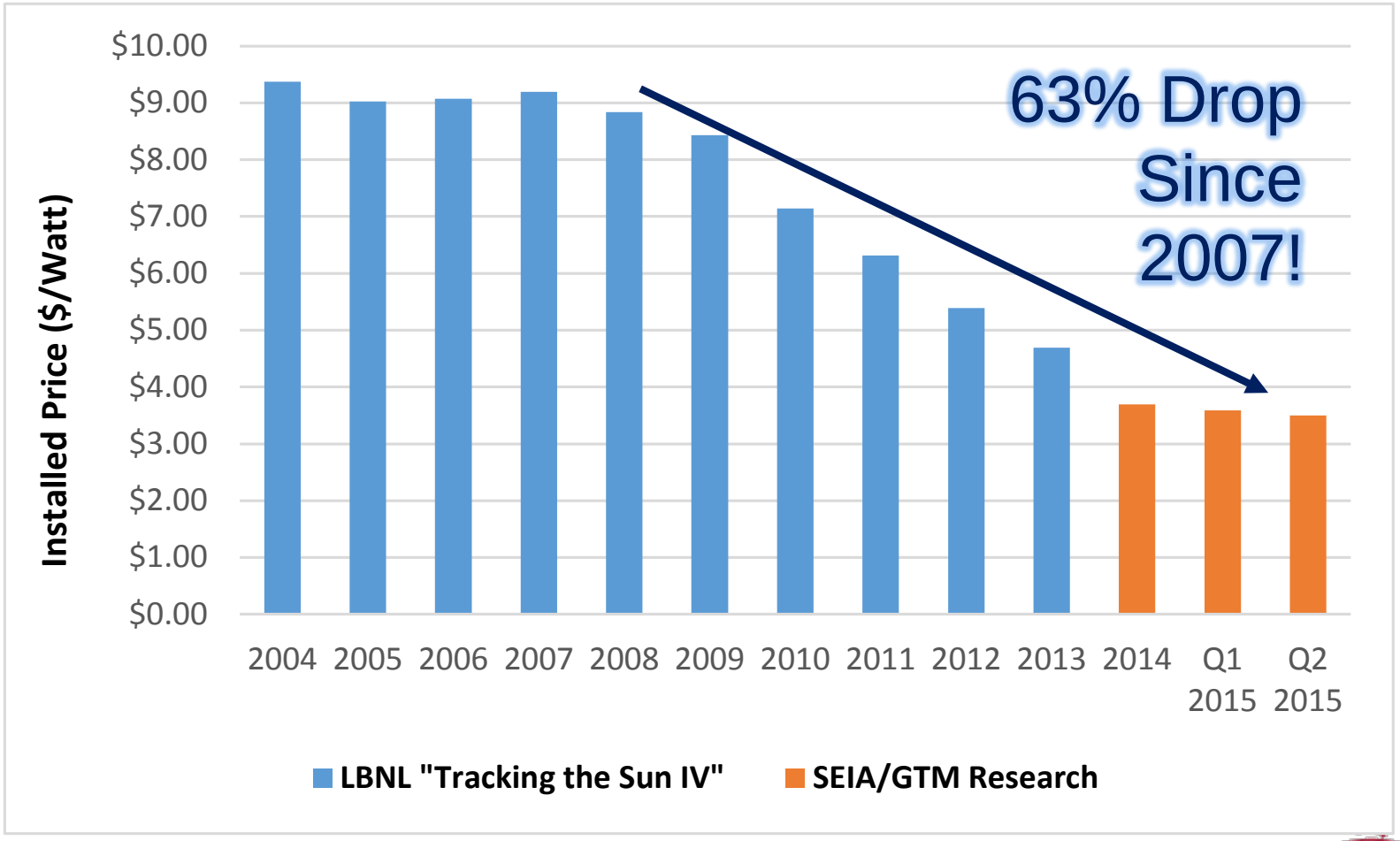
PV Is More Affordable Than Ever

Average PV System Gross Installed Costs



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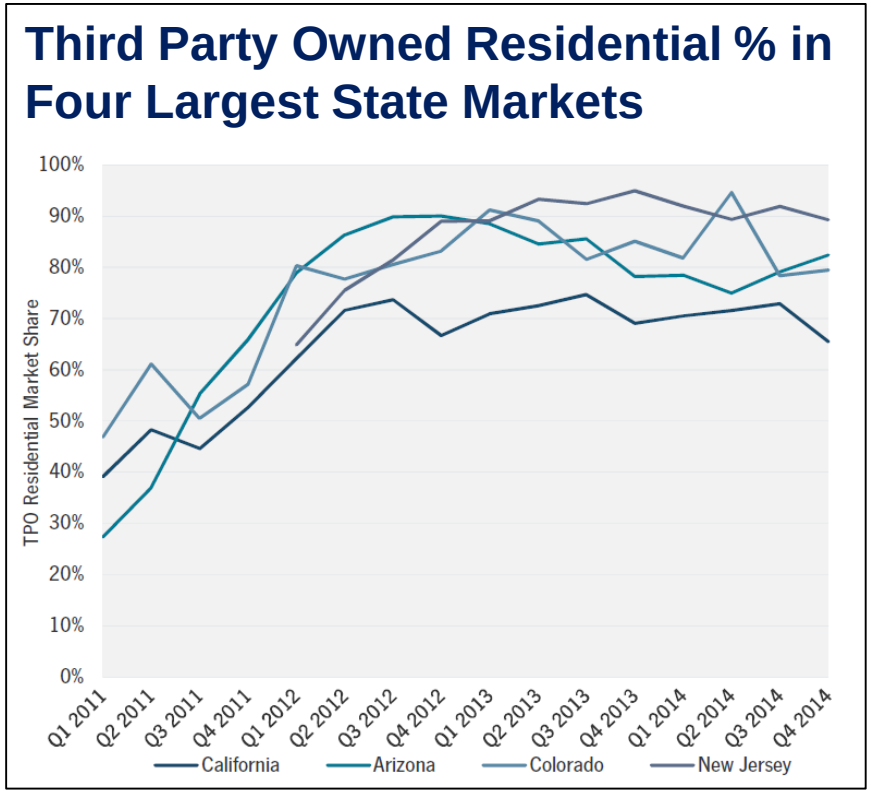
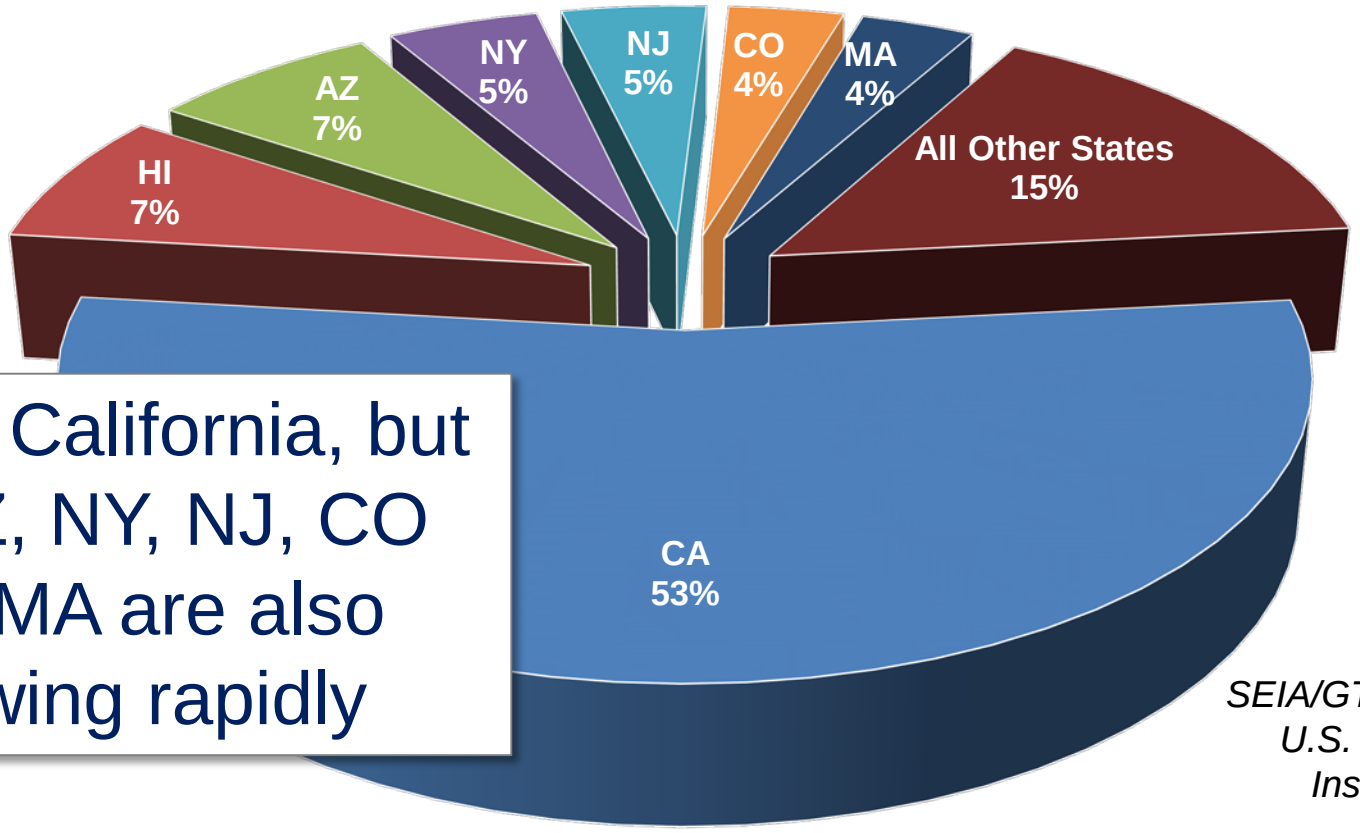
As Well There Has Been Stable National Policy & Market Innovations

- Federal Uncapped 30% ITC has been in place since 2008
- State policies have been progressive and relatively stable
- Leases, PPAs, and Solar Loans have proliferated (see right)



Sources: GTM & SEIA, 2015; Heeter, Barbose et al, 2014

Leading To Over 725,000 US Residential Installations Through Q2 2015



53% in California, but HI, AZ, NY, NJ, CO and MA are also growing rapidly

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

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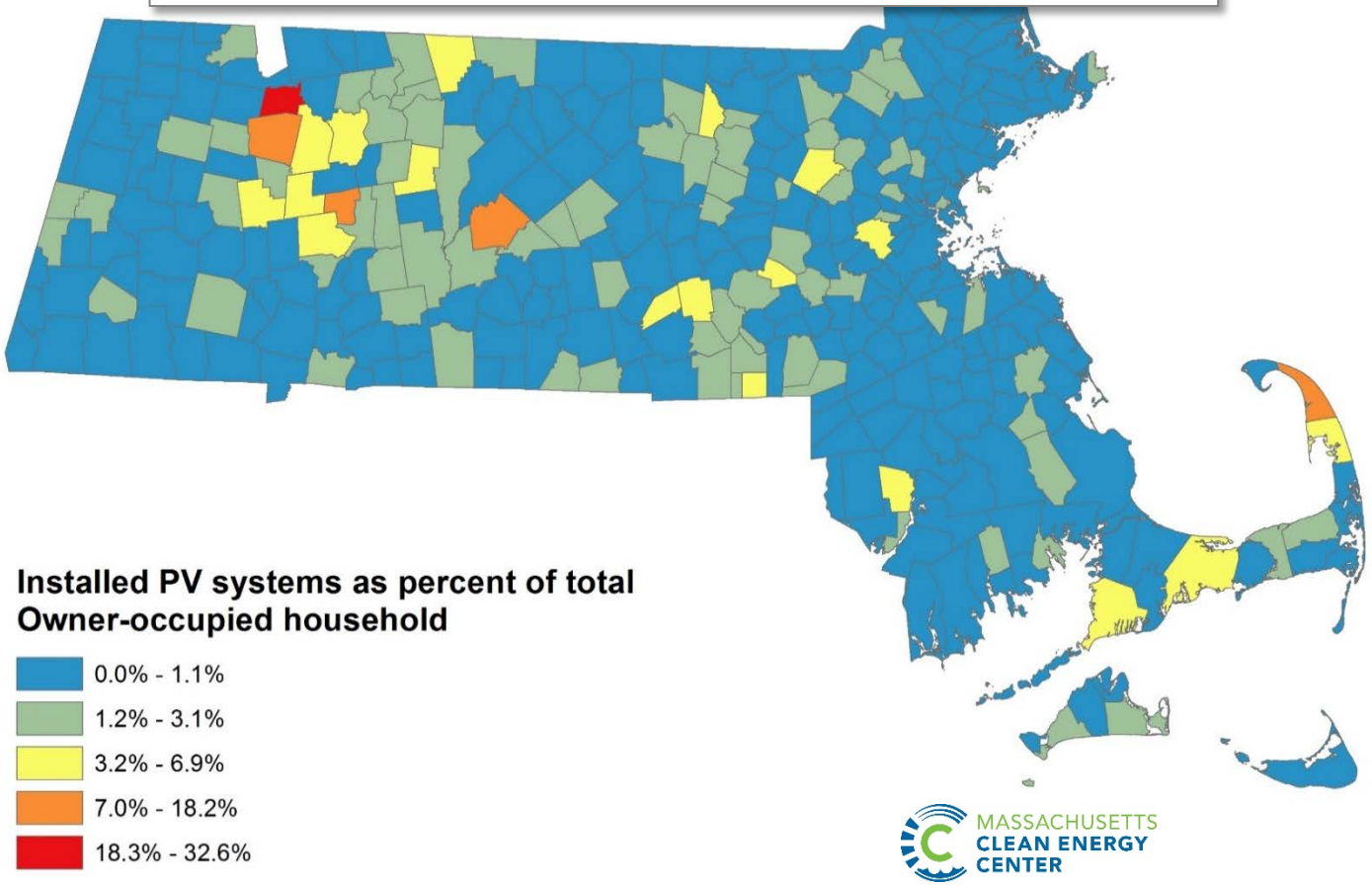
In Some Locations 10-20% Of The Homes Have Solar

Example From Massachusetts



Source: Massachusetts Clean Energy Center Production Tracking System

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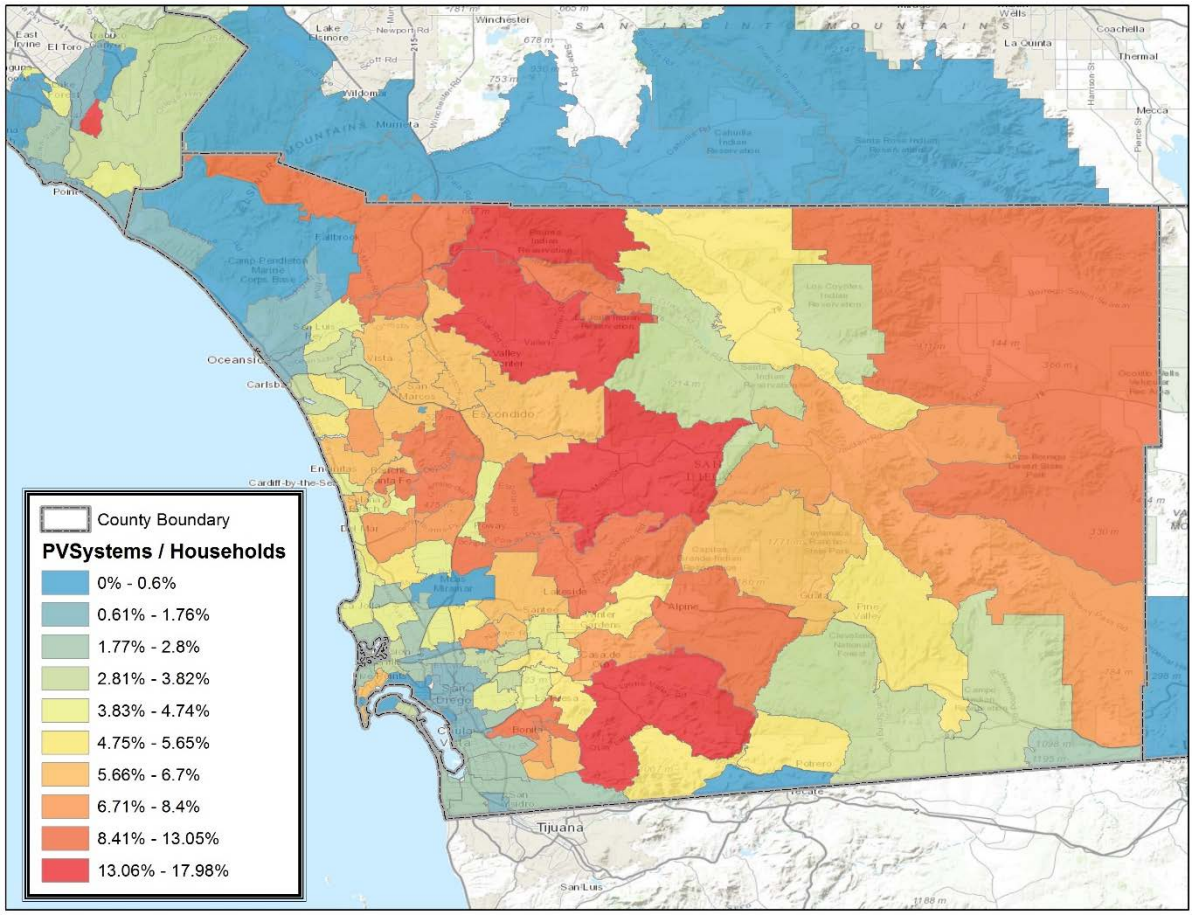
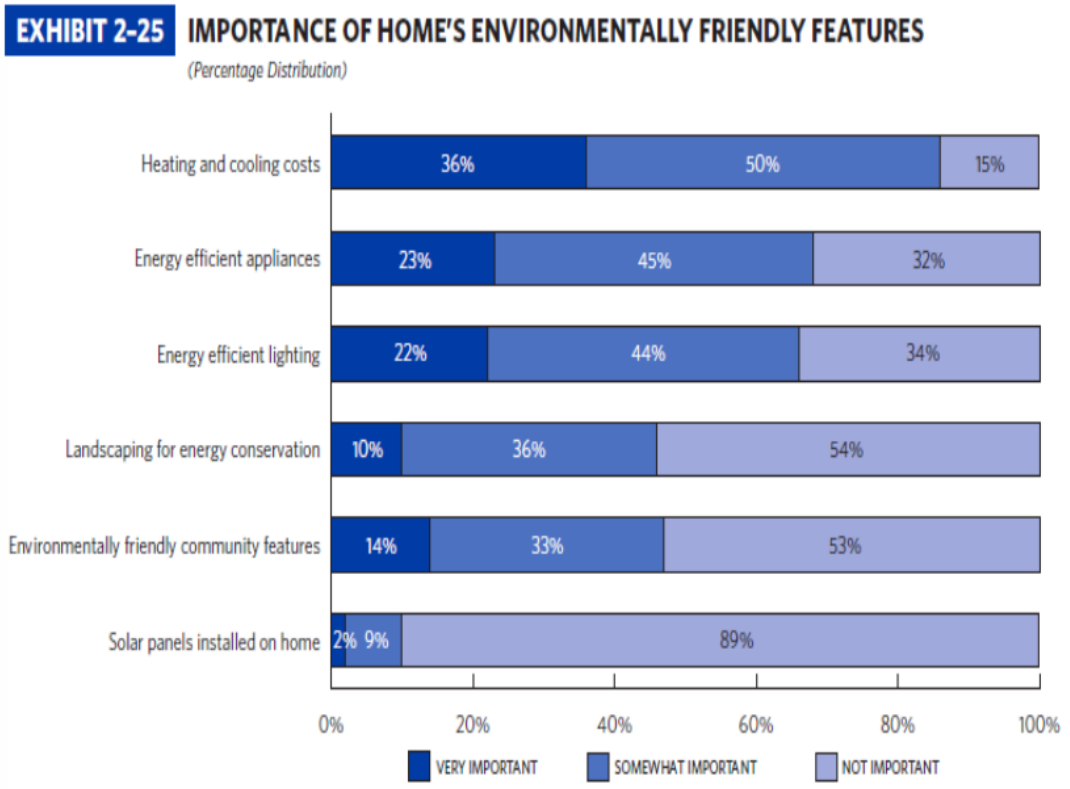
In Some Locations 10-20% Of The Homes Have Solar

Example From San Diego



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

Home Buyers Want Green Features In General And Solar In Particular



12% Say Solar Is “Important”

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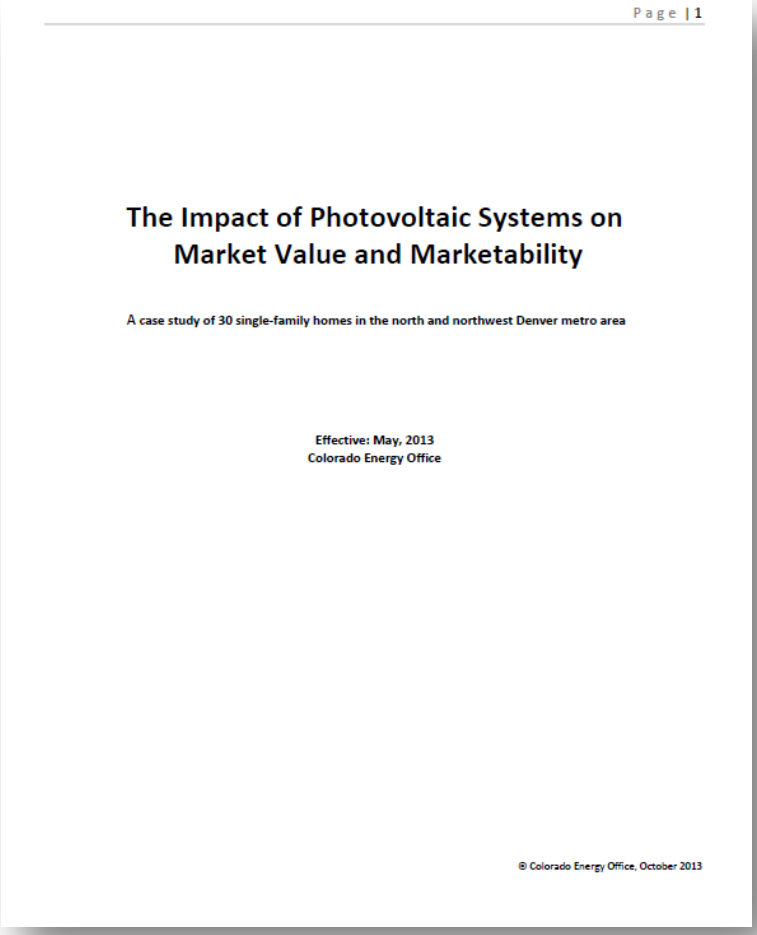
But What About The Value Of These Homes?

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; 2013; 2015

Appraiser Led Small Scale Studies Have Resulted In Similar Findings



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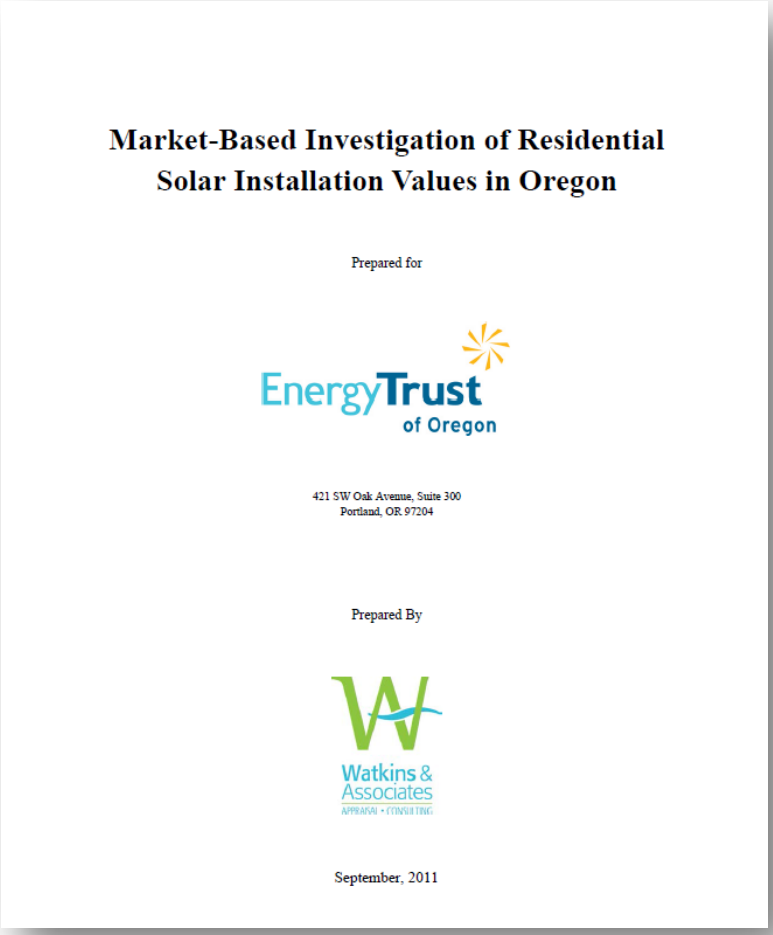
The Impact of Photovoltaic Systems on Market Value and Marketability

A case study of 30 single-family homes in the north and northwest Denver metro area

Effective: May, 2013
Colorado Energy Office

© Colorado Energy Office, October 2013



Market-Based Investigation of Residential Solar Installation Values in Oregon

Prepared for

EnergyTrust of Oregon

421 SW Oak Avenue, Suite 300
Portland, OR 97204

Prepared By

Watkins & Associates
APPRAISAL • CONSULTING

September, 2011

Desmarais, 2013; Watkins, 2011

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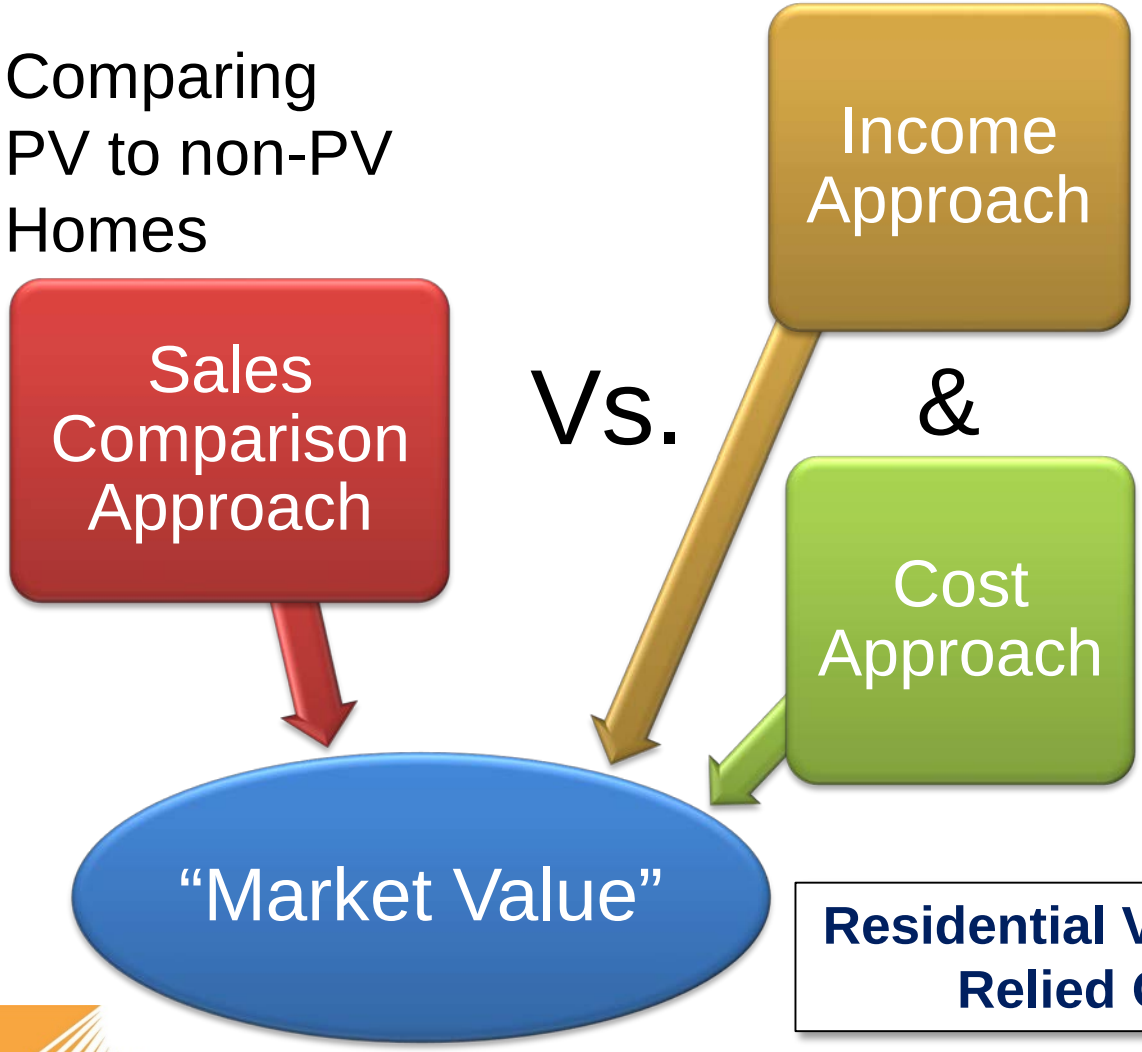
Prior To 2015, There Were Significant Limitations To That Literature

- Appraiser led studies had been conducted in only two states
- Appraisal results had not been compared directly to statistical results
- Time on the market had only been looked at in one study
- Appraisal results had not been compared to both income and cost approaches
- Cost approach, taking into account incentives, had not been examined in a non-statistical study
- An examination of the percent of solar sales in a market that would be good for paired-sales analysis had not been conducted

Having Expanded Valuation Methods Accepted By Practitioners and Institutions Is Needed

Comparing PV to non-PV Homes

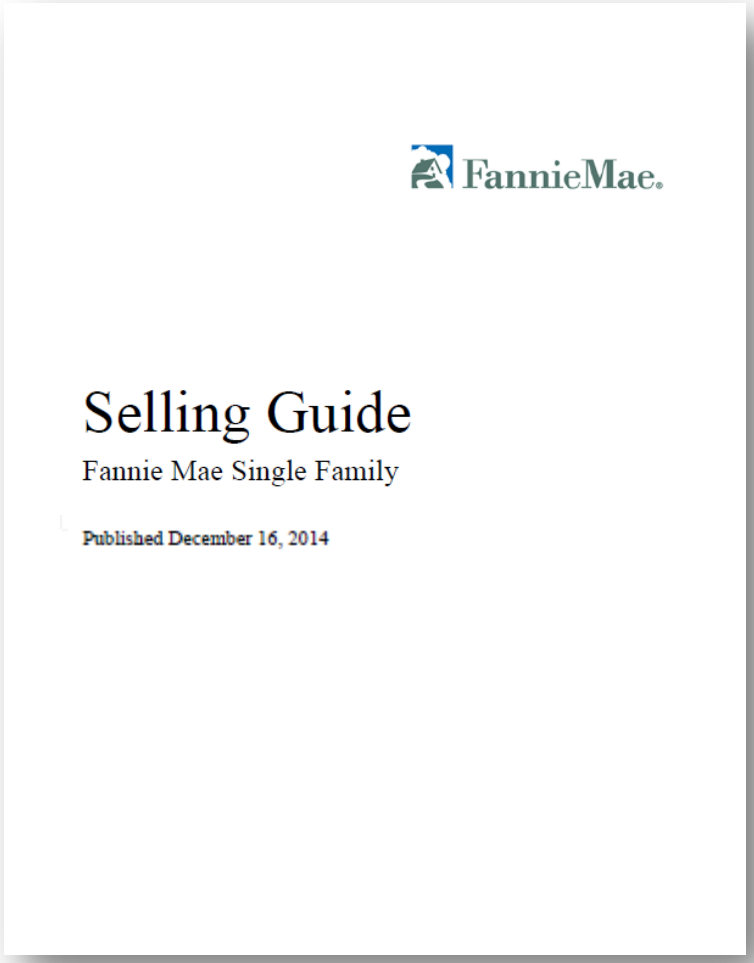


Income Approach using PV Value®: Present value of stream of energy cost savings

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

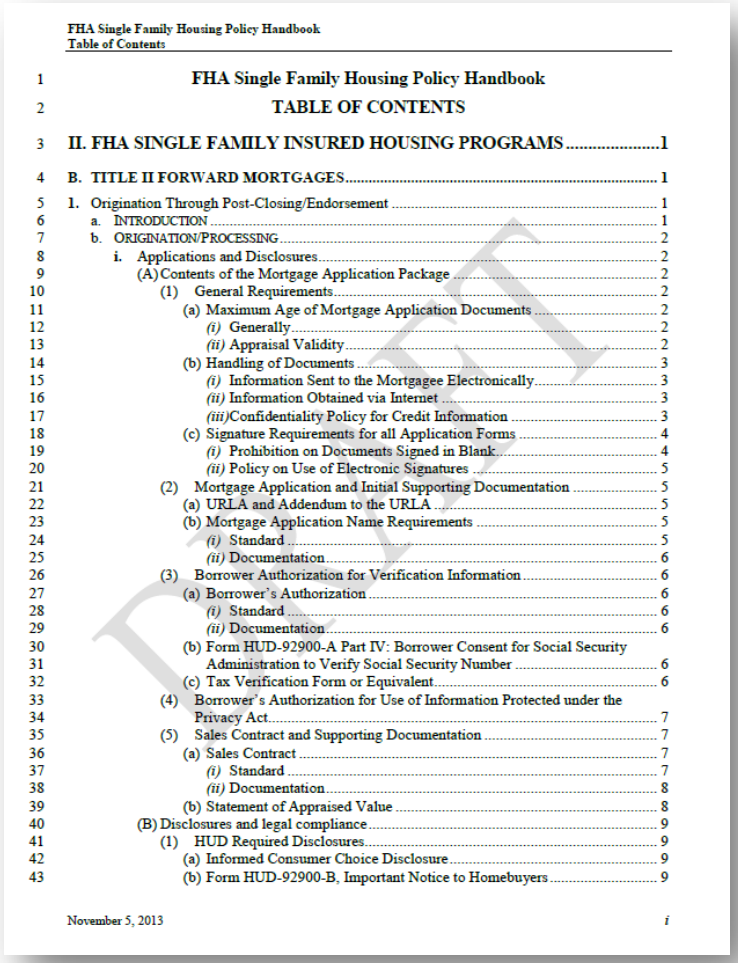


FannieMae.

Selling Guide

Fannie Mae Single Family

Published December 16, 2014



FHA Single Family Housing Policy Handbook

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DOE Funded LBNL To Conduct Research To Help Fill Those Gaps

- Work started in late 2014
- Completed late 2015
- Involved 7 appraisers
- Covered sales in 6 states
- Used sales analyzed in "Selling Into The Sun"
- Focused on **Host-Owned Systems**

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~~

20%

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**

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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)

- For each PV home a similar non-PV home (i.e., “Pair”) is found
- Adjustments for non-PV differences are made based on local market
- Any remaining difference is attributed to the solar system
- Estimates using Income and Cost Methods are also generated
- Each pair is reviewed by at least one other appraiser
- Appraisers also determine the Time On The Market for the transactions to occur

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Data Spanned A Wide Set Of Characteristics and Prices

	Minimum	Median (50th)	Mean	Maximum
Sale Price	$ 150,000	$ 405,000	$ 431,964	$ 1,050,000
Sale Year	2010	2012	2012	2014
System Size (watts)	1000	3850	3783	9600
System Age (Years)	0.0	2.2	2.7	11.4
Income Estimate ($/watt)	$ 1.01	$ 2.03	$ 2.46	$ 4.42
Gross Cost Estimate ($/watt)	$ 4.00	$ 5.46	$ 5.48	$ 7.30
Net Cost Estimate ($/watt)	$ 1.48	$ 3.32	$ 3.10	$ 4.32

$/Watt = Dollars/Size of the PV System in Watts

For Example: $10,000 Income Estimate for a 5,000 Watt system = $2/Watt

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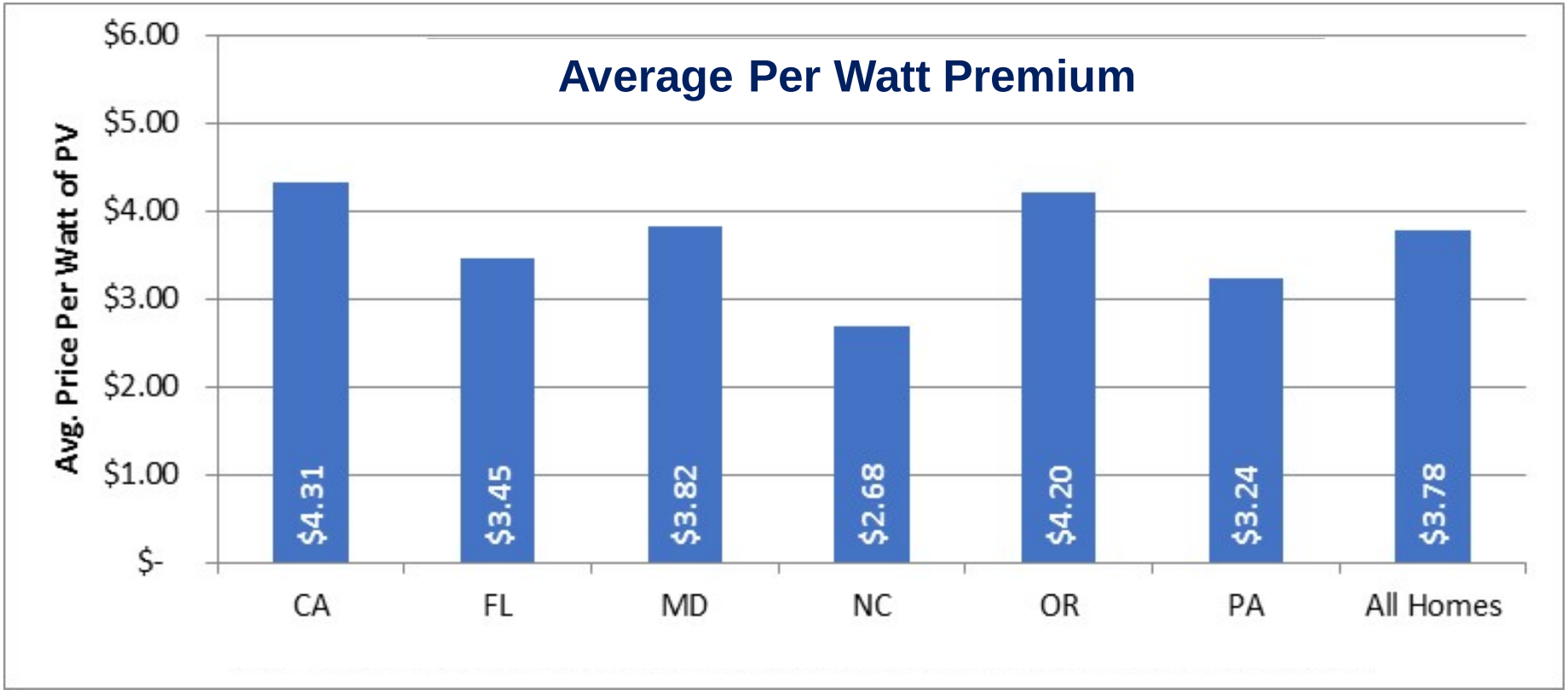
Premiums Are Clearly Evident Across All States



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)

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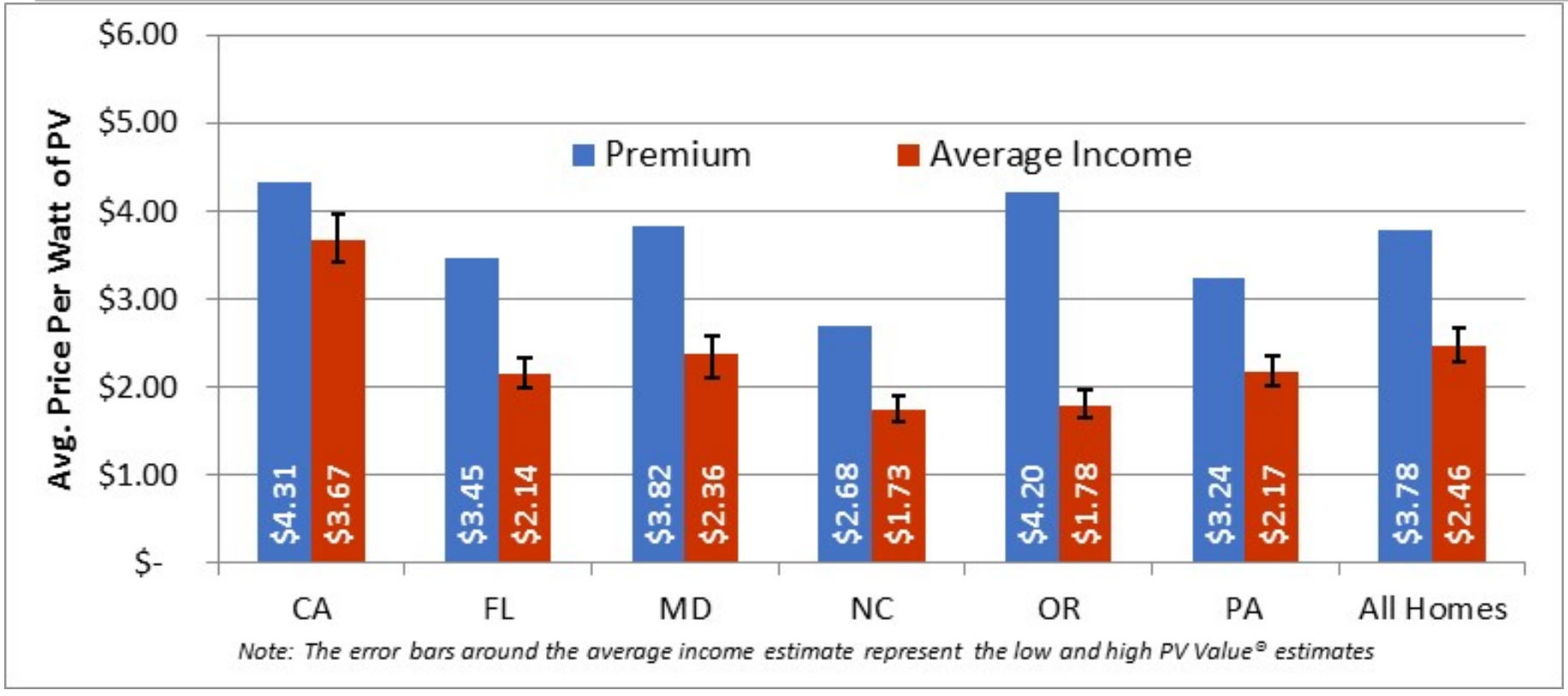
Premiums Are Higher Than Income Estimates (Especially OR)

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)*

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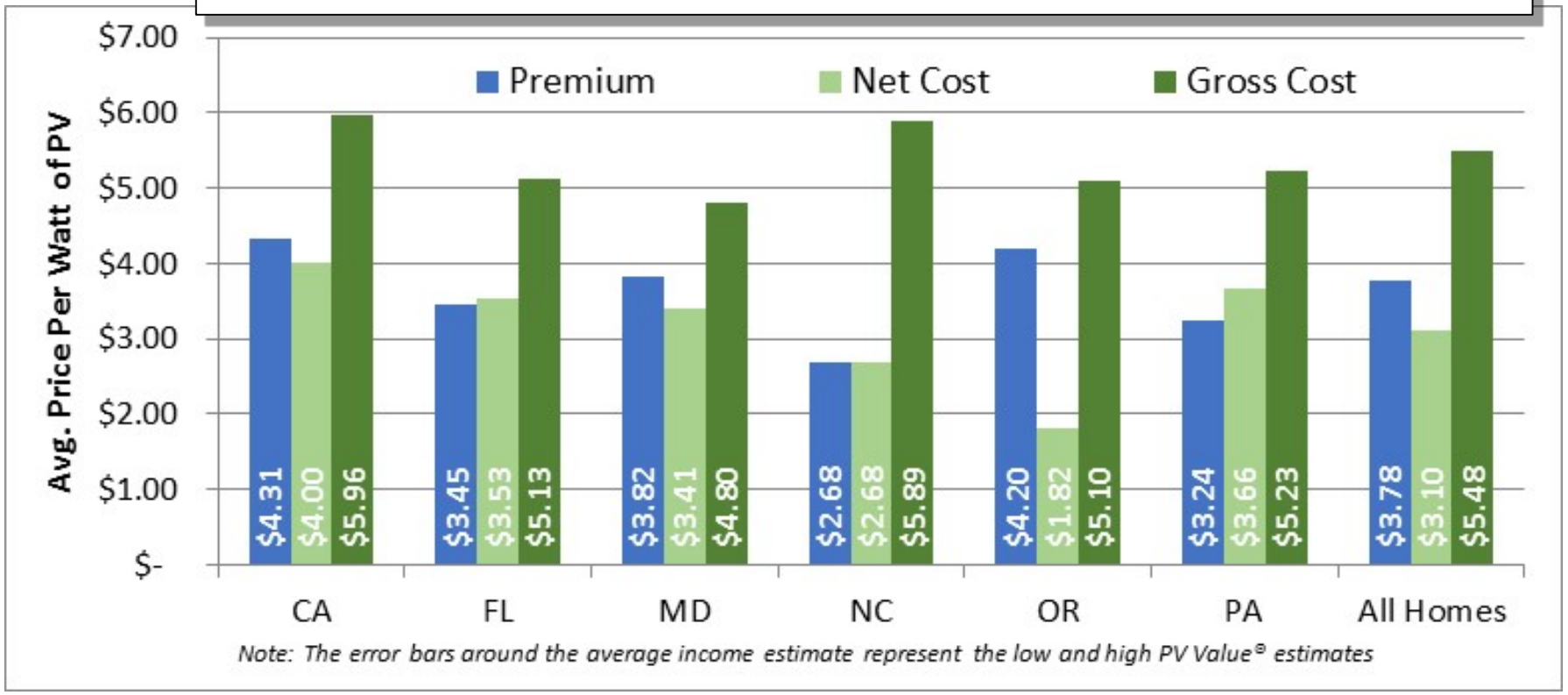
Premiums Are Most Similar To Net Cost Estimates (But Not OR)

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)

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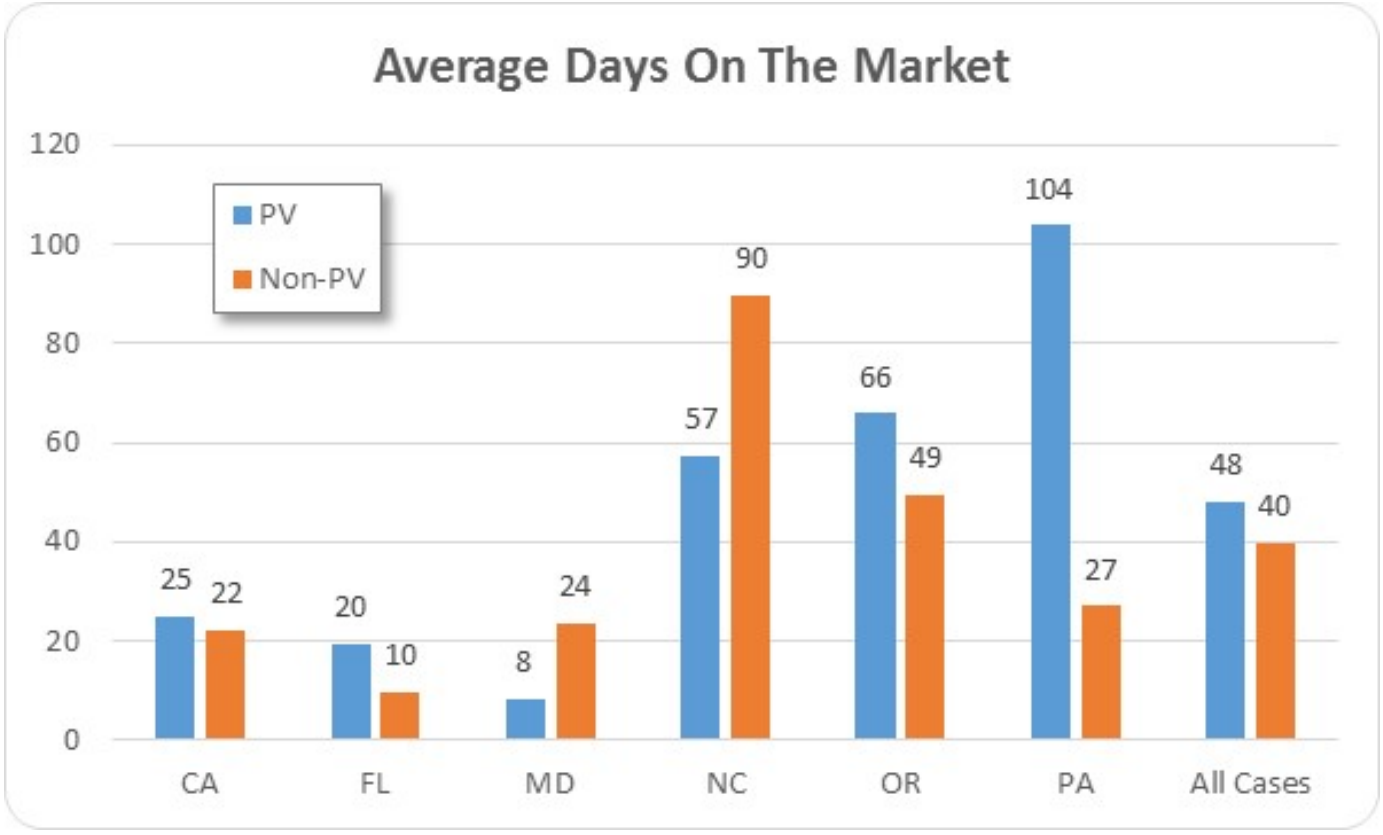
Average Days On The Market Are Not Different For These PV Homes

In Some States PV Homes Sell Slower, In Others Faster



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

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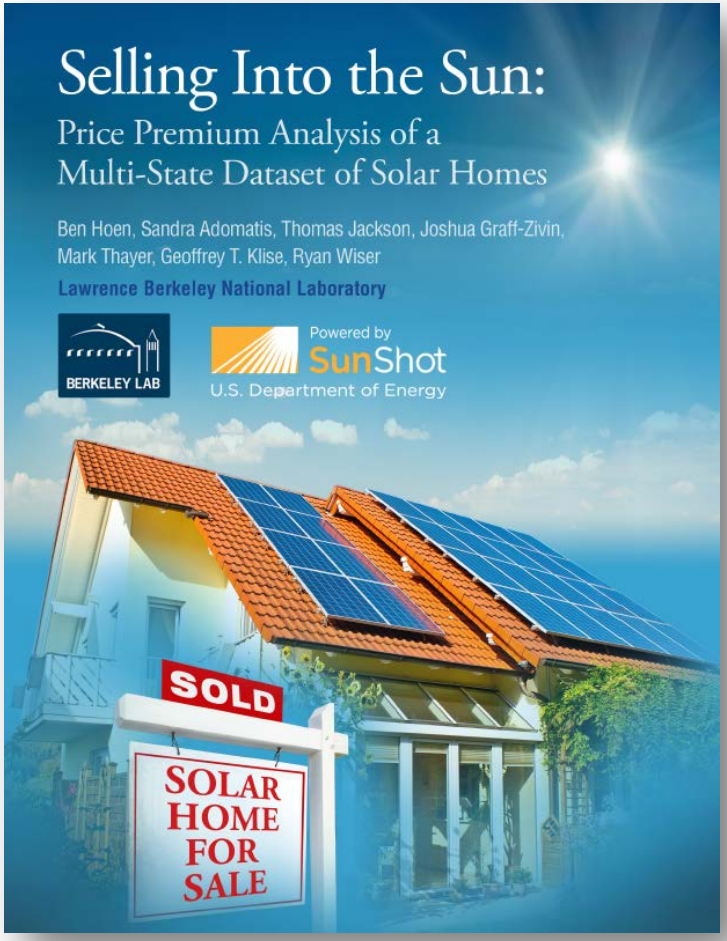
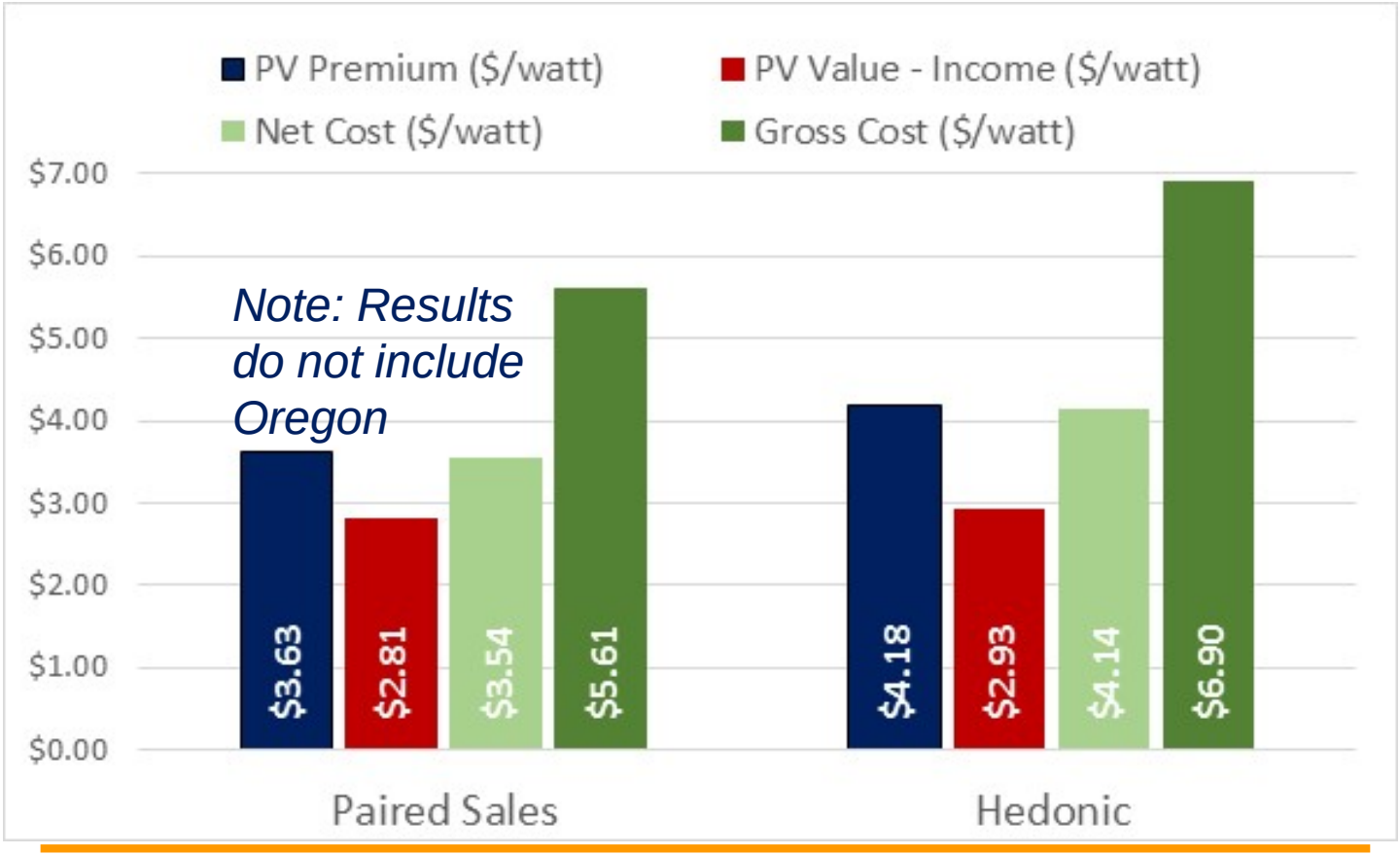
Comparison Of Methods
Paired Sales Vs. Hedonic Pricing Model

- Different methodologies
- Overlapping datasets
- Similar approaches: premiums vs income/cost
- Similar time frames:
  Paired Sales 2010-2014
  Hedonic 2002-2013



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



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Conclusions

- In many markets finding sales to pair can be very difficult
- PV consistently adds value (~ $3.75/watt in our sample for sales in 2012)
- Clear premiums exist in each state sub-sample
- “Net” cost estimates are better proxy than “gross”
- Income estimates are conservative in comparison to yet correlated with premiums
- Results from this study conform to the hedonic study – bolstering both
- When no comparable sales are available net cost and income methods are reasonable proxies
- No difference is observed from days on the market

Although we found Premiums in our average 2012 sample, Premiums for other homes would be based on their respective market characteristics at their time of sale.

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Upcoming LBNL Research

- Survey of Buyers/Sellers/Realtors involved in sales of homes with 3rd party owned PV systems *(with Center of Sustainable Energy in San Diego)* **– Soon!**
- Statistical analysis of ~ 400 sales of homes with 3rd party owned systems as well as ~ 30 paired sales of those homes *(with Sandy, another appraiser, and academic team)* **– Mid 2016!**
- Roadmap describing possible scenarios to have PV system characteristics auto-populate into Multiple Listing Services *(with Elevate Energy)* **– Late 2016!**
- Characterization and analysis of commercial PV property market **– 2017/2018!**

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Thank You! Questions?

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