Third Party Owned Solar PV:

Data Summary Of 294 TPO Contracts
(For Homes That Have Sold In California)

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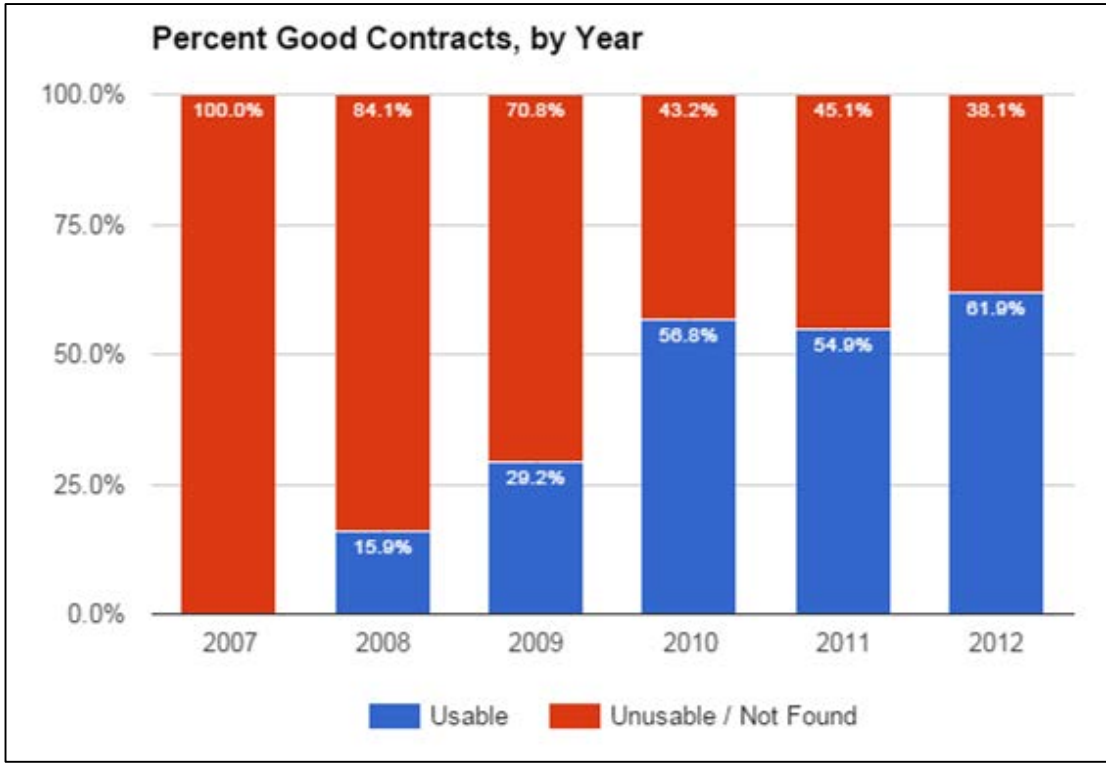
More Recent Contracts Are More Likely To Be Found And Contain Usable Data*

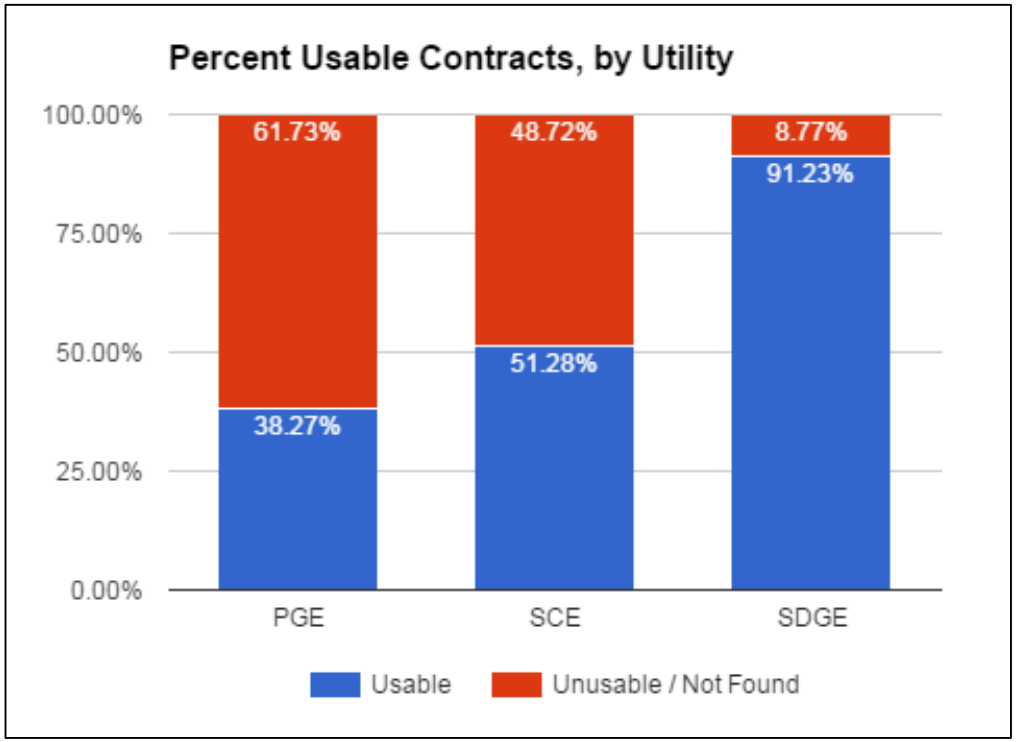
	Found and Usable		Not Found / Not Usable	
YEAR	n	%	n	%
2007	0	0.0%	17	100.0%
2008	14	15.9%	74	84.1%
2009	19	29.2%	46	70.8%
2010	100	56.8%	76	43.2%
2011	96	54.9%	79	45.1%
2012	65	61.9%	40	38.1%
TOTAL	294	47.2%	332	52.8%



*Many contracts we searched for were not found in the set received from the CPUC. Other contracts were found, but contained only a signature page with no useful data.Still other contracts were between TPO company and installer, rather than homeowner, so contained little useful data.

PGE Contracts Were More Frequently Not Found Or Not Usable, But Still Provided More Contracts Than Other Utilities

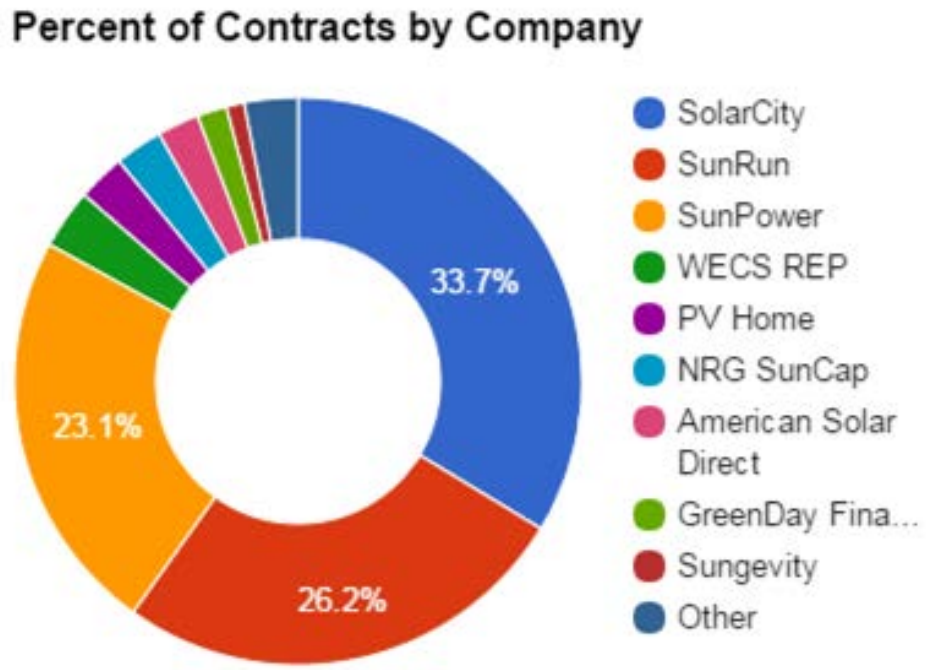
	Found and Usable		Not Found / Not Usable	
UTILITY	**n**	**%**	**n**	**%**
PGE	142	38.3%	229	61.7%
SCE	100	51.3%	95	48.7%
SDGE	52	91.2%	5	8.8%
SMUD	0	0.0%	3	100.0%
TOTAL	294	47.2%	332	52.8%



PGE - Pacific Gas & Electric
SCE - Southern California Edison
SDGE - San Diego Gas & Electric

A Plurality Of Contracts Were From SolarCity, SunRun, and SunPower, With Only 17% From Other Companies

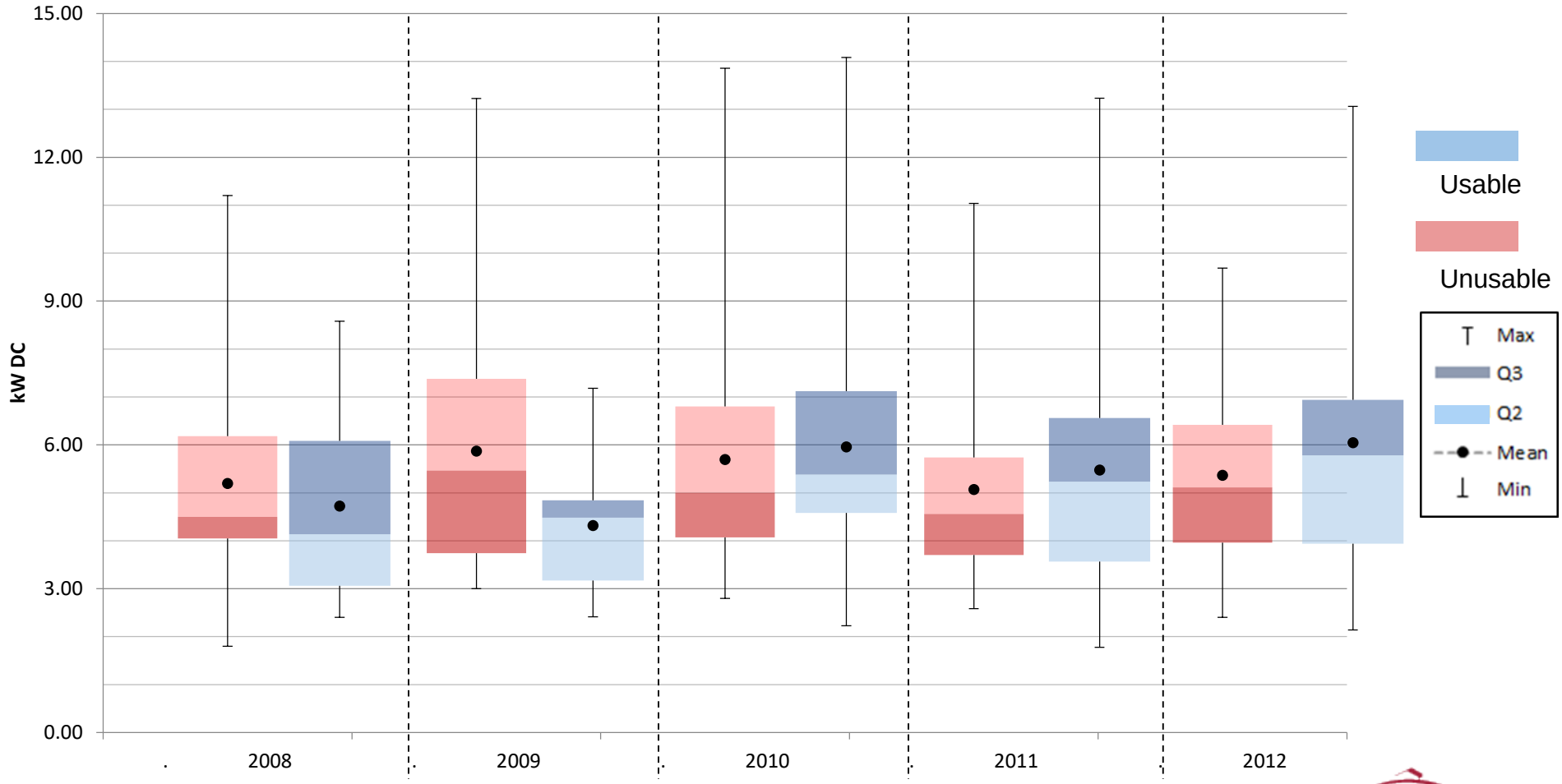
TPO Company	n (Usable)	% (of all Usable)
SolarCity	99	33.67%
SunRun	77	26.19%
SunPower	68	23.13%
WECS REP	10	3.40%
PV Home	8	2.72%
NRG SunCap	8	2.72%
American Solar Direct	7	2.38%
GreenDay Finance	5	1.70%
Sungevity	3	1.02%
Other	9	3.06%
TOTAL	294	100%



**Note - in subsequent slides, SolarCity, SunRun, and SunPower will be identified as the "Big 3," and all other companies will be listed as "other".*

System Size is Similar Between Usable and Unusable Leases

Comparing mean size of usable (5.69 kW) to unusable (5.44 kW): Difference = 0.25 kW, *p*-value = 0.155 across all years



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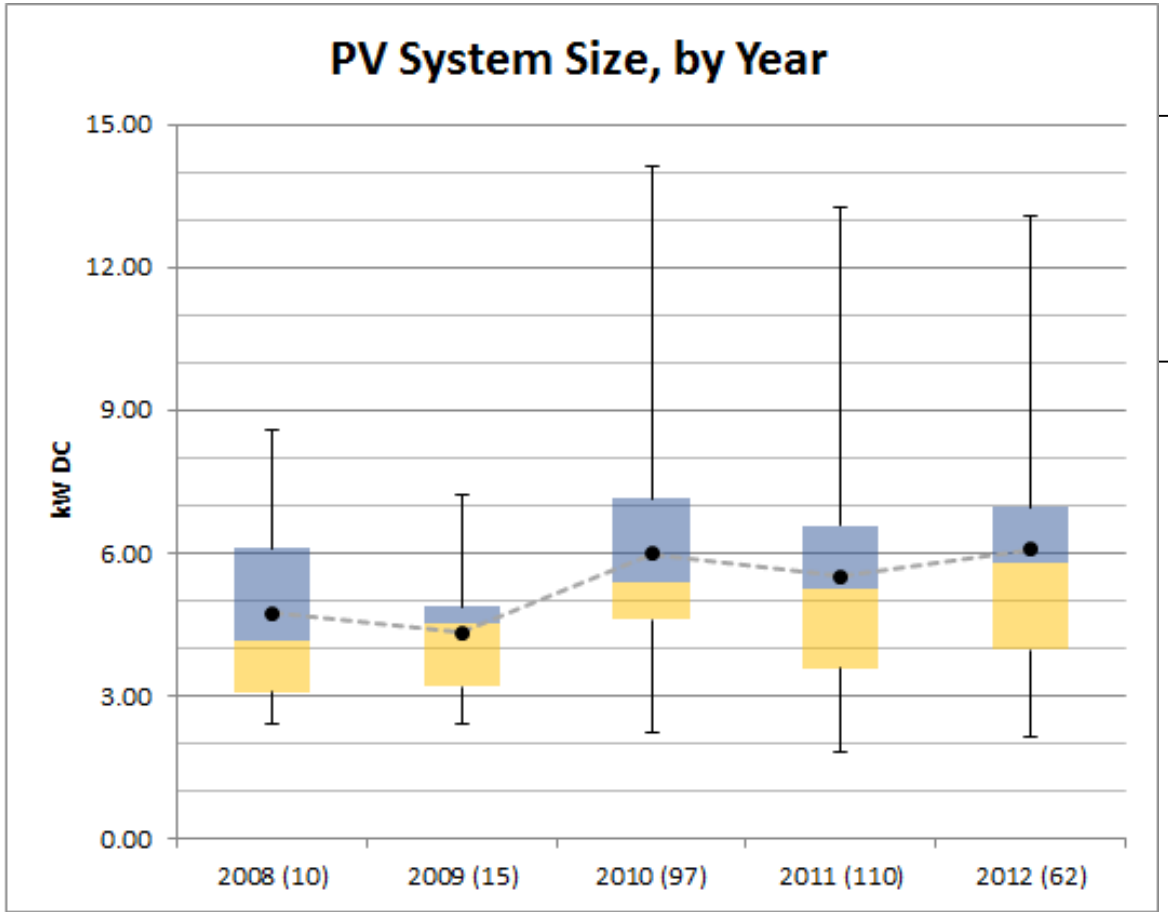
TPO PV System Size Increasing Only Slightly Over Time

Full Sample: (kW DC)

Mean:	5.69 kW
Maximum:	14.1 kW
Minimum:	1.8 kW
St. Dev. :	2.28 kW

n = 294 (100% of usable)

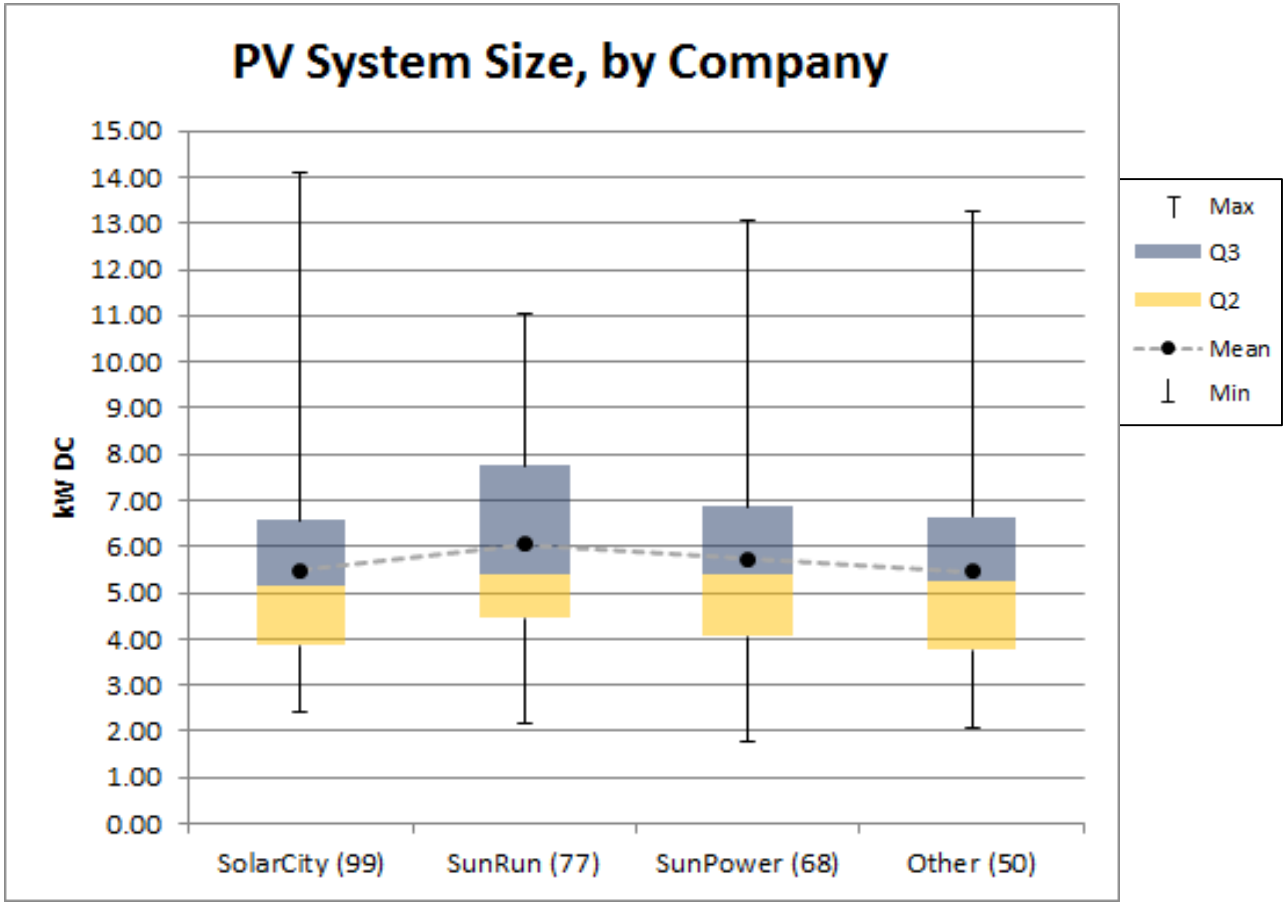


PV System Size Is Relatively Consistent Across TPO Companies

Full Sample: (kW DC)

Mean:	5.69 kW
Maximum:	14.1 kW
Minimum:	1.8 kW
St. Dev. :	2.28 kW

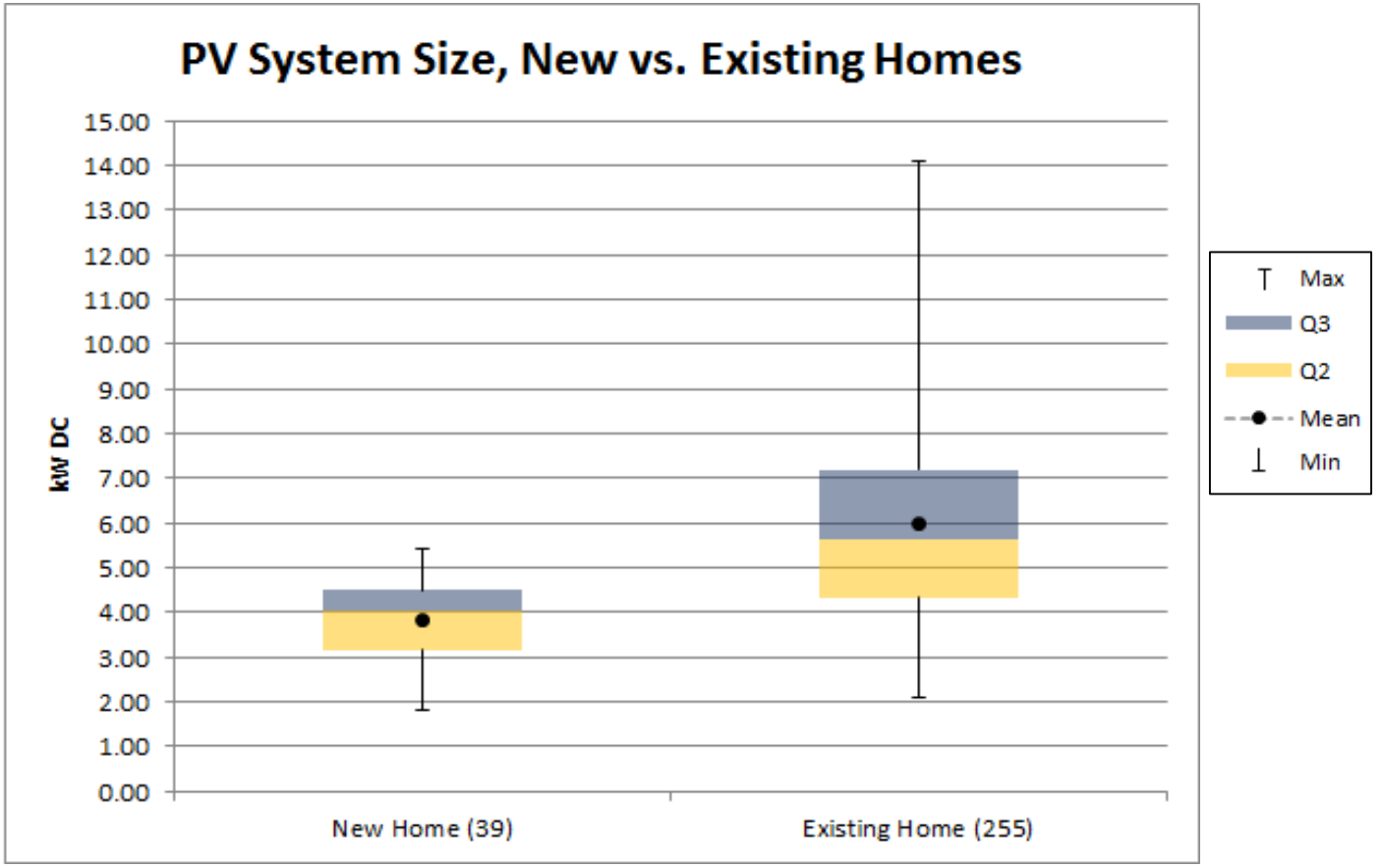
n = 294 (100% of usable)



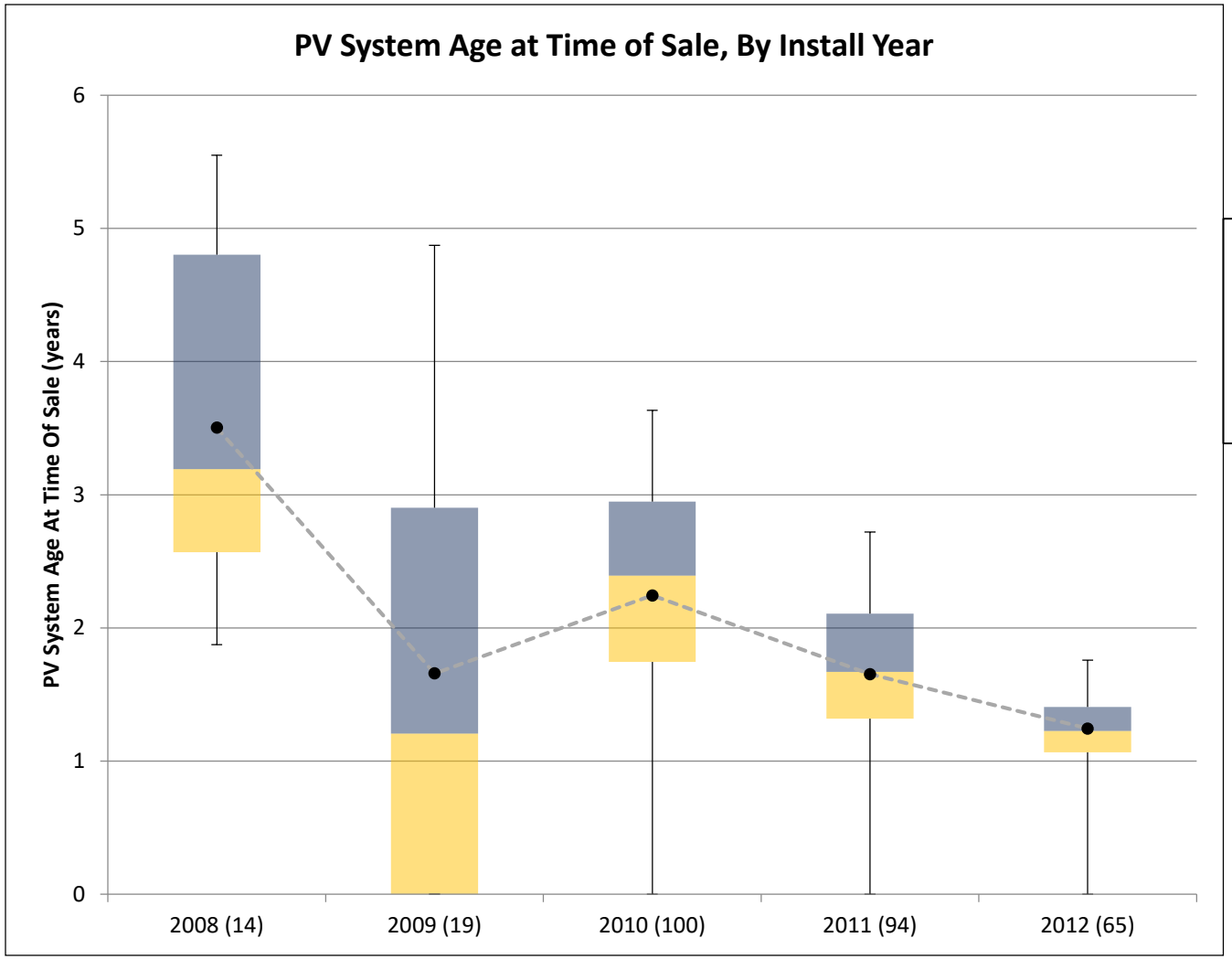
TPO PV Systems Installed on New Homes Are Significantly Smaller Than Systems Installed on Existing Homes

Full Sample: (kW DC)
Mean: 5.69 kW
Maximum: 14.1 kW
Minimum: 1.8 kW
St. Dev. : 2.28 kW

n = 294 (100% of usable)



Earlier PV System Install Year Correlates To Higher System Age At Time Of Sale



n = 292 (99% of usable)

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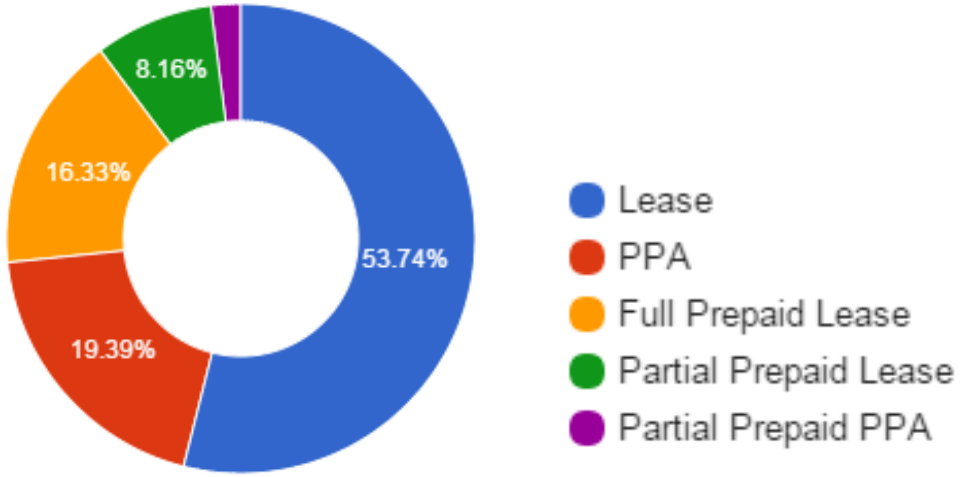
Lease Dataset
PV System Information (Size, Age at Sale)
Lease Type (Payment Structure, Term, Prepay Amount)
Costs (monthly payments, marginal costs, electricity rate)
End of Term Value

Lease Is Dominant Payment Structure But PPA and Prepay Have Become More Common

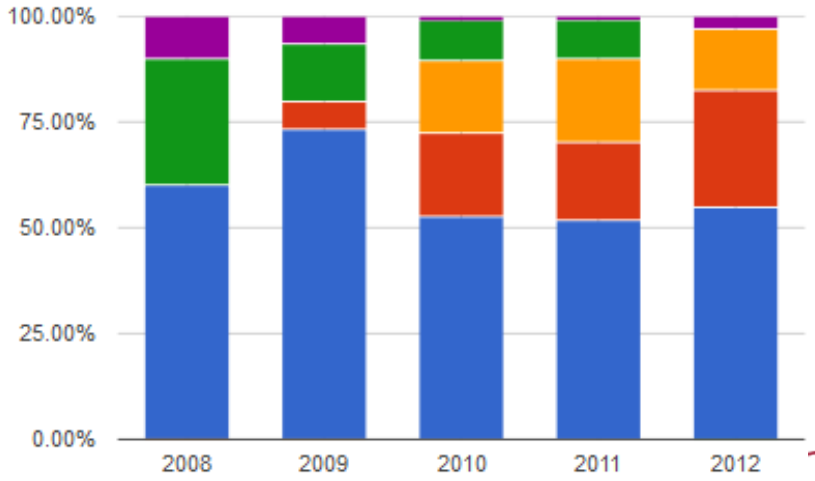
Payment Structure	Number of Leases	Percent (%)
Lease	159	53.7%
PPA	57	19.4%
Full Prepaid Lease	48	16.3%
Partial Prepaid Lease	24	8.2%
Partial Prepaid PPA	6	2.0%
Total	294	100%

"Lease" - Flat fixed monthly payment.
"PPA" - Power Purchase Agreement.
(Electricity generated is purchased at a fixed rate per kWh.)
"Prepay" - Portion of the lease paid before installation

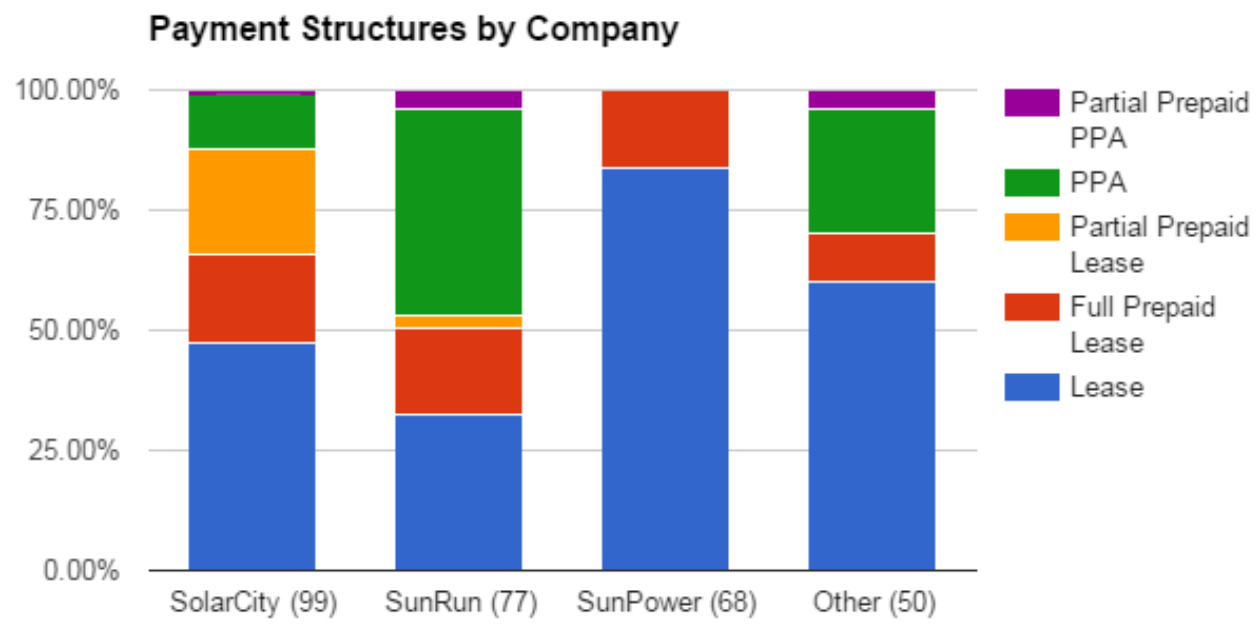
Payment Structure by Type



Payment Structure Type by Year



Individual Companies Have Employed A Variety of Payment Structures



"Lease" - Flat fixed monthly payment.

"PPA" - Electricity generated is purchased at a fixed volumetric rate.

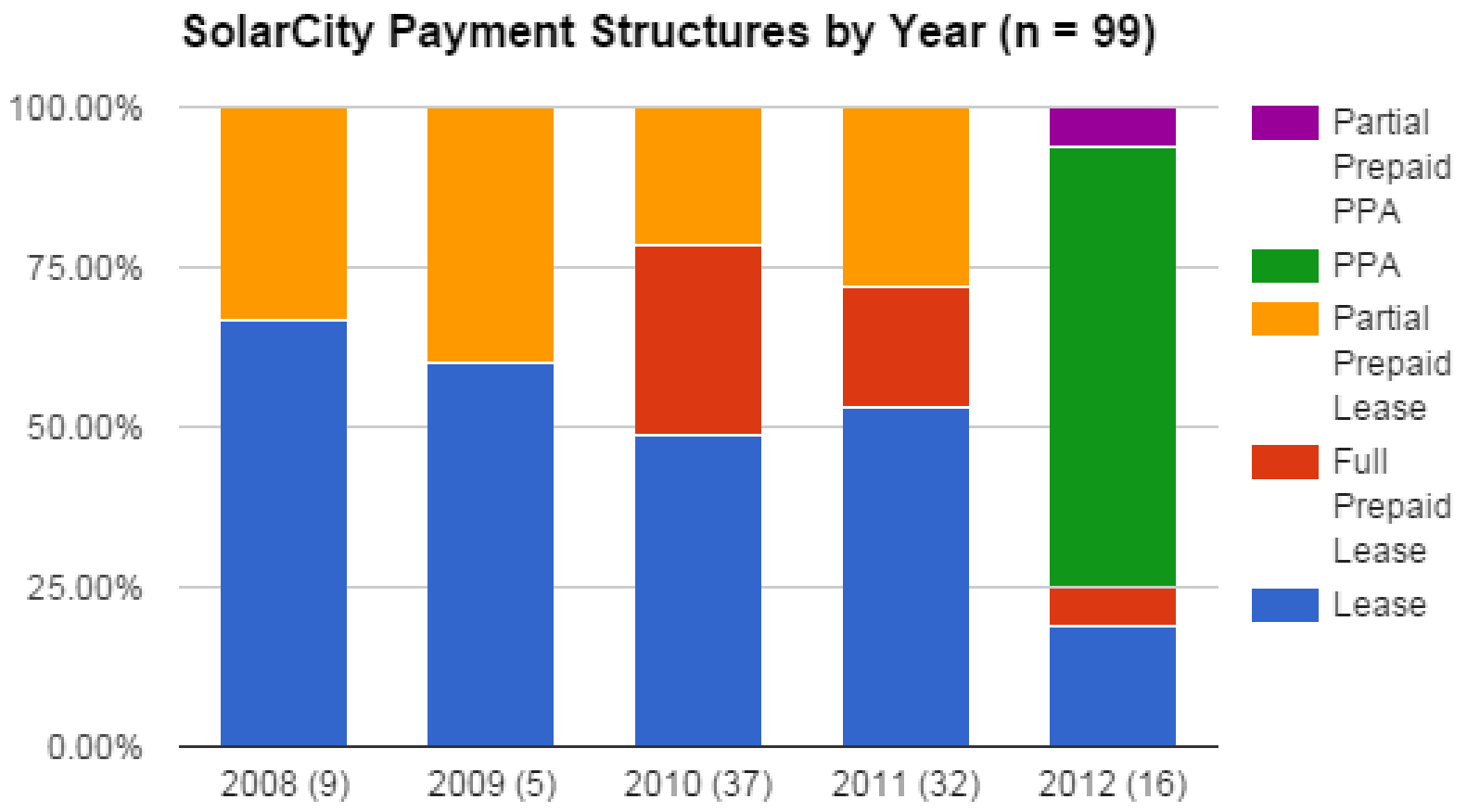
"Prepay" - Portion of the lease paid before installation

"Other" included:

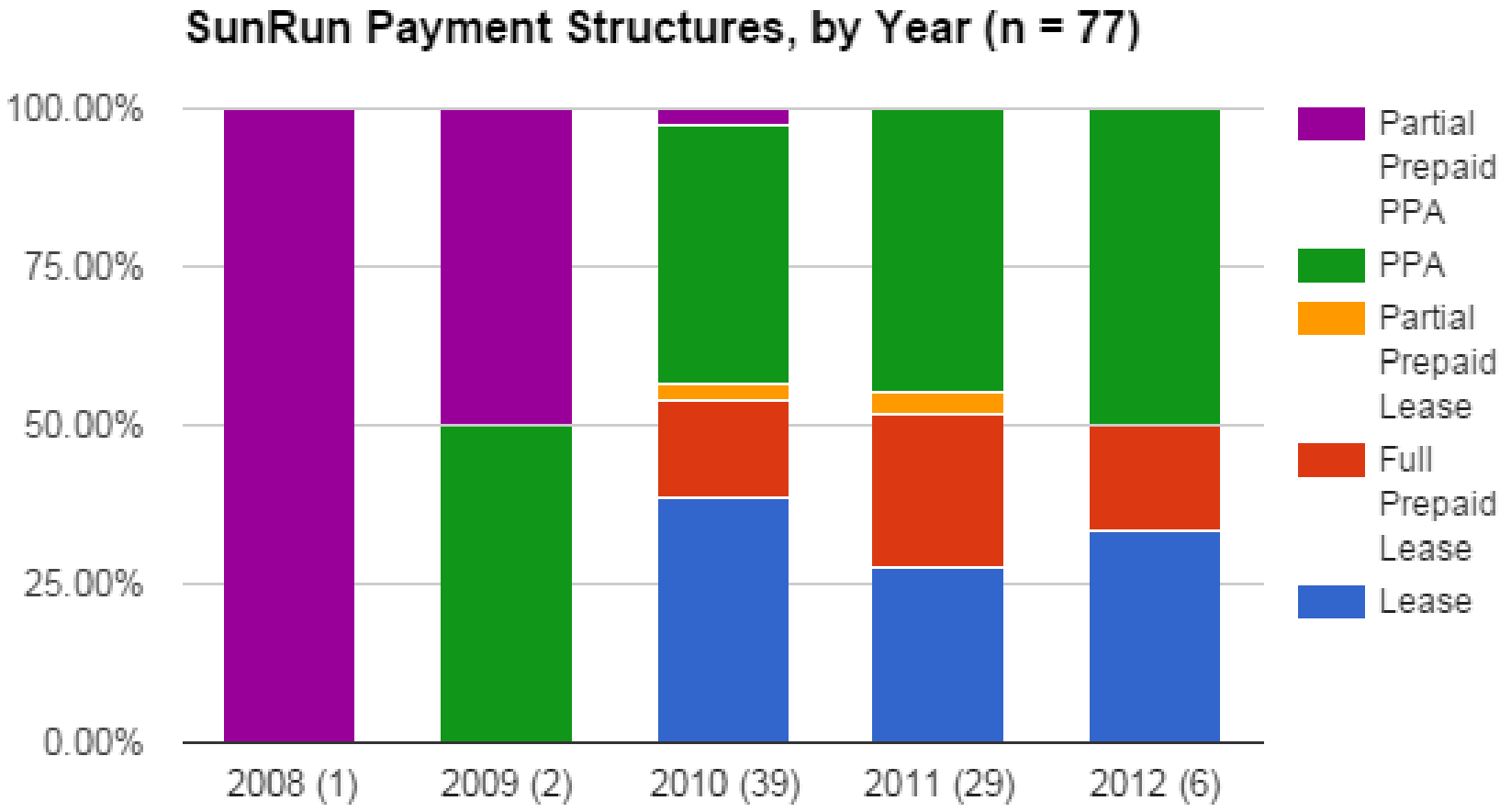
- *WECS REP*
- *American Solar Direct*
- *PV Home*
- *NRG SunCap*
- *GreenDay Finance*
- *Sungevity*
- *Hot Solar*
- *California Clean Energy*
- *Lotus Clean Energy*
- *Apex Solar*
- *Barnes Solar*
- *MYSOLAR*

n = 294 (100% of usable)

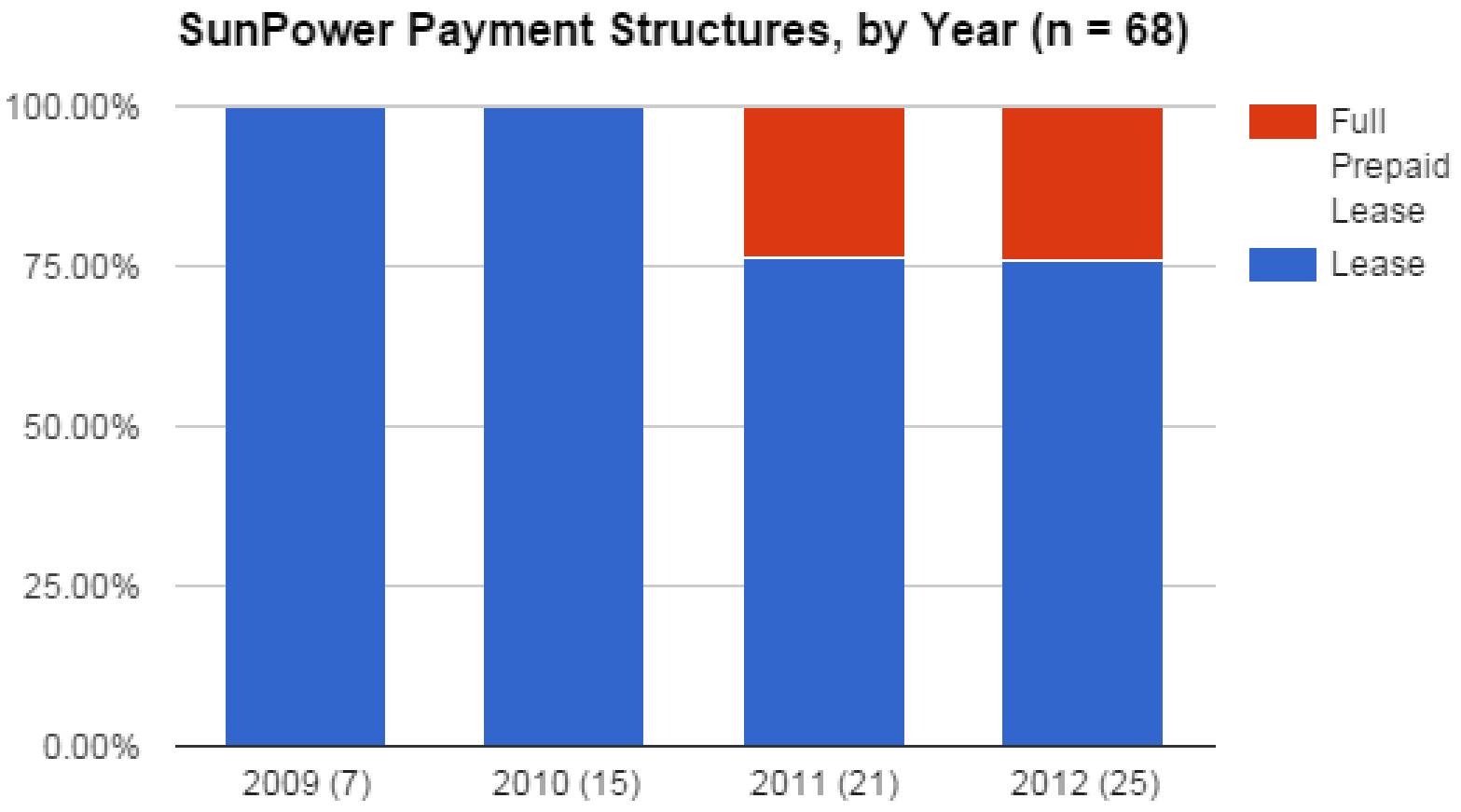
SolarCity Payment Structures Trending From More Leases to More PPAs



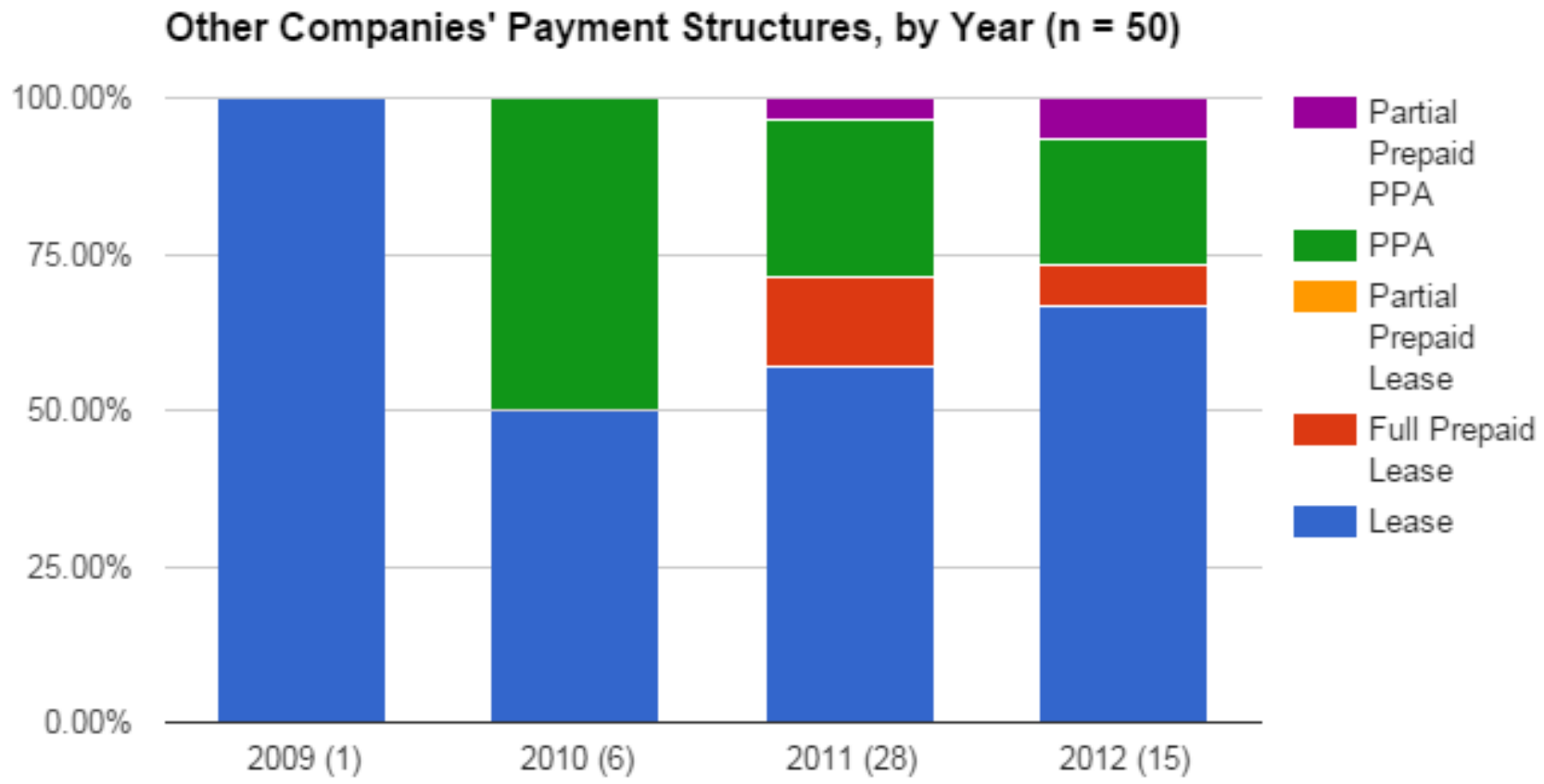
SunRun Uses Mix of PPA and Lease Payments



SunPower Predominantly Uses Lease Payments



Other Companies Use A Variety Of Structures, But Lease Payments Are Majority

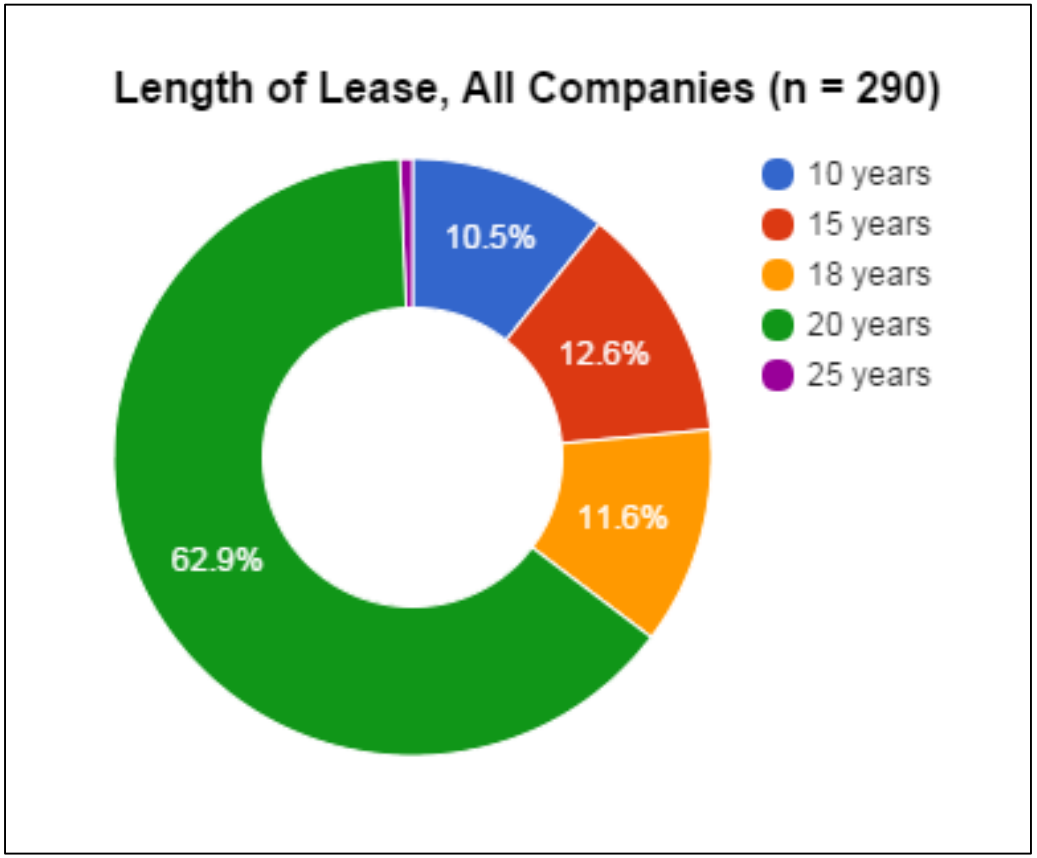


Majority of Leases Are 20 Years,
But Shorter (10-18 Years) Leases Also Common

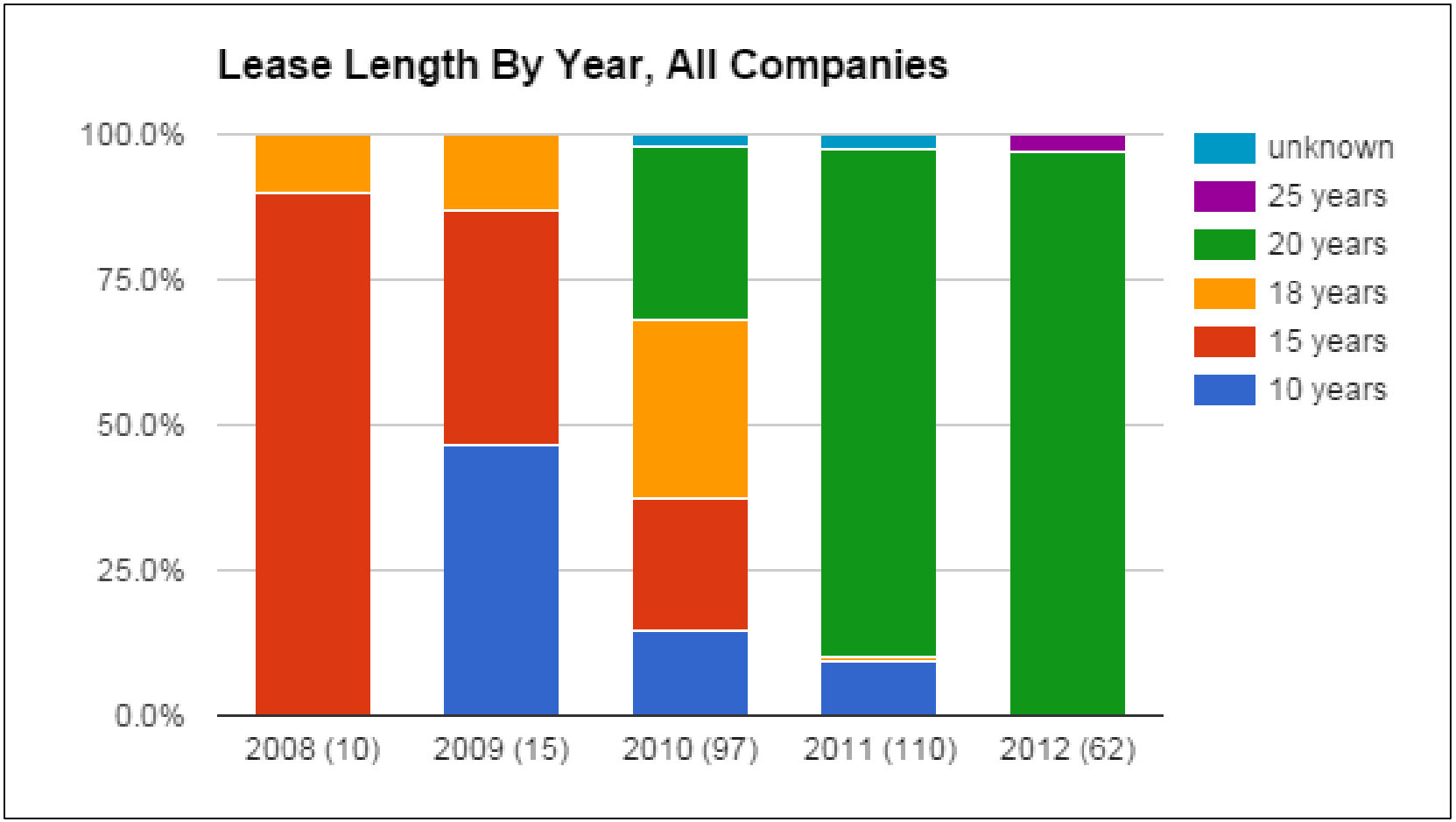
10 Years*:	10.5 %
15 Years:	12.6%
18 Years:	11.6 %
20 Years:	62.9 %
25 Years:	0.7 %

**10 year leases were all for new homes*

n = 290 (98.5% of usable)

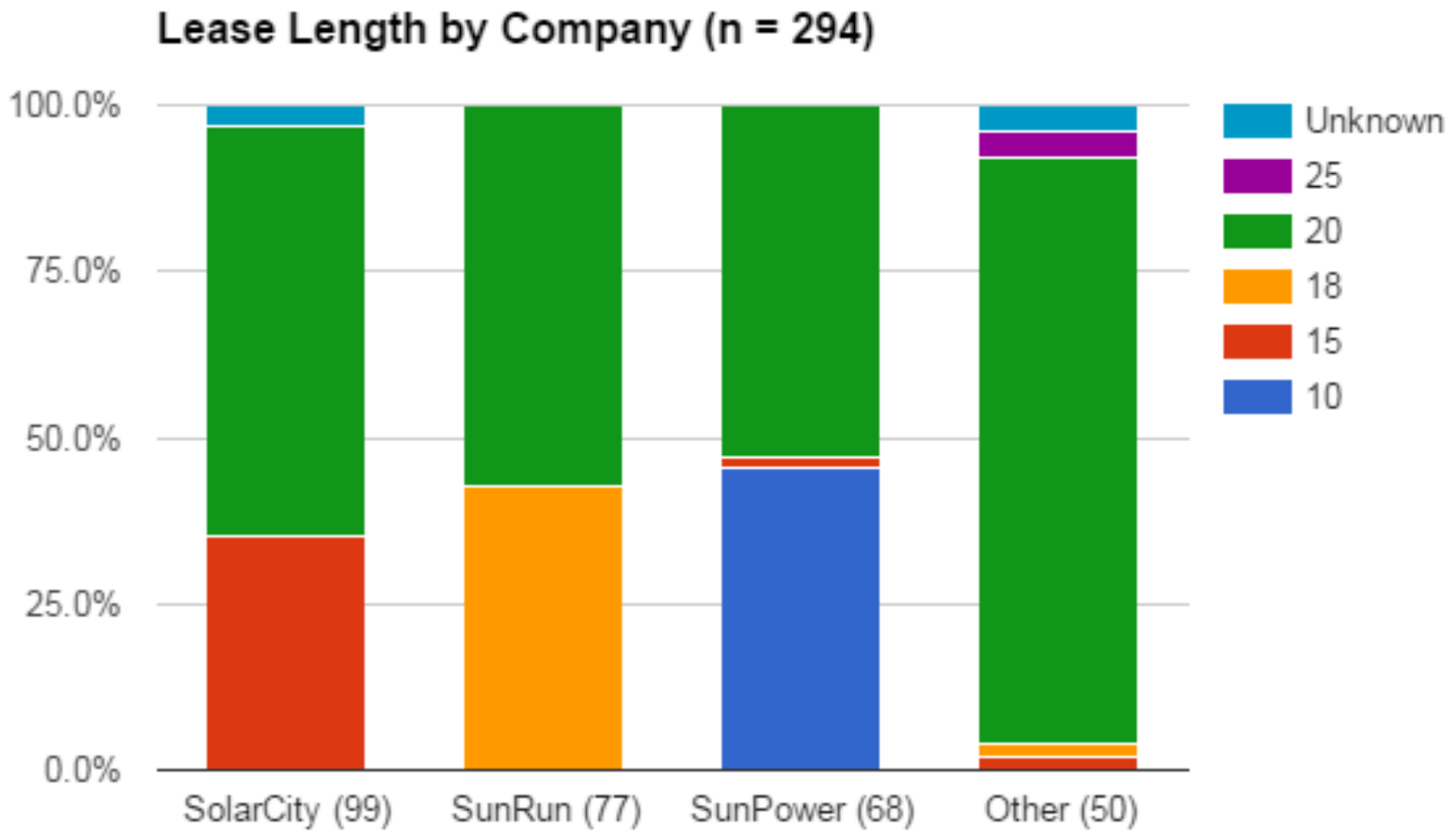


Lease Length is Increasing Over Time



n = 294 (100% of usable)

20-Year Lease Is Dominant Across Companies



n = 294 (100% of usable)

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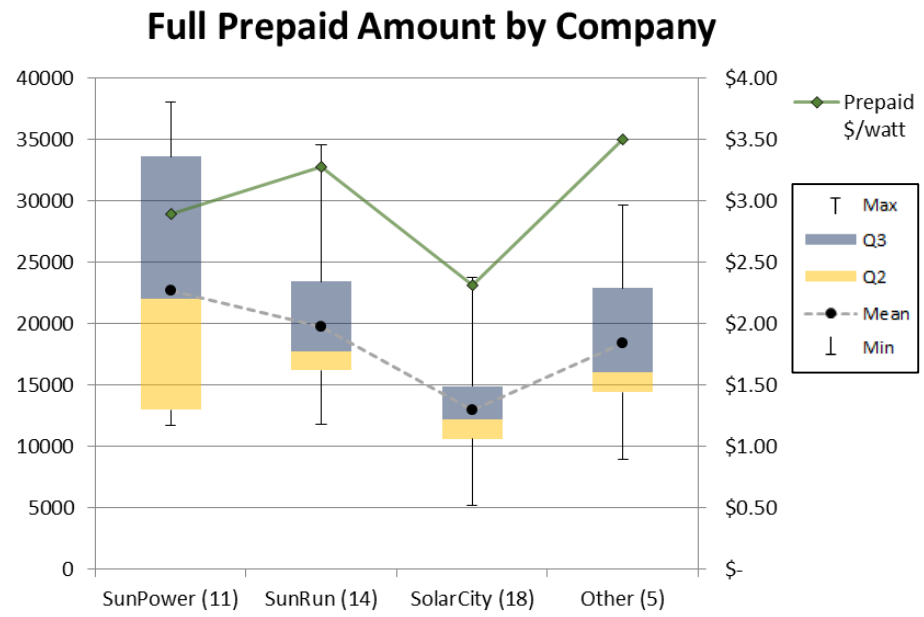
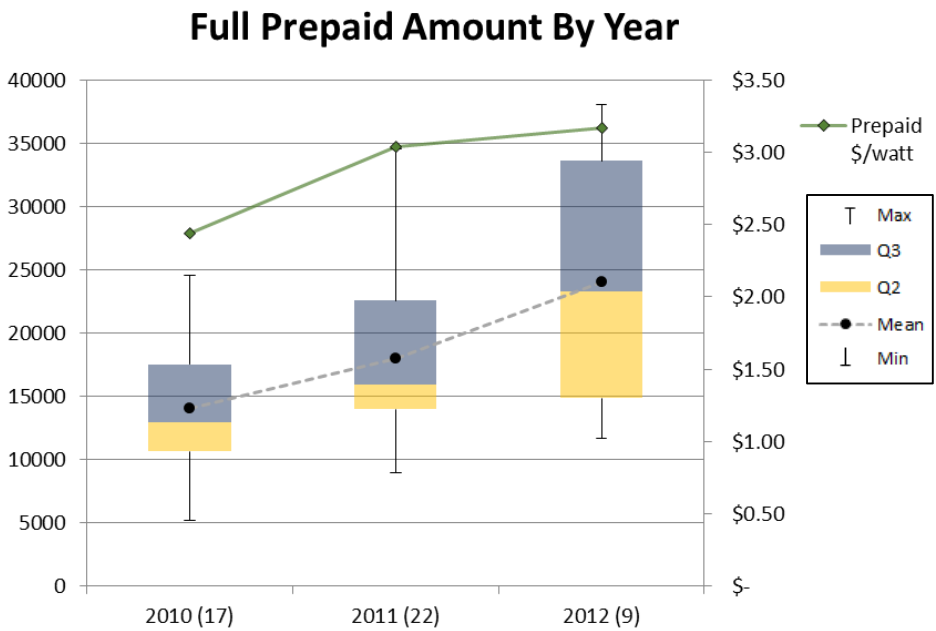
Lease Dataset
PV System Information (Size, Age at Sale)
Lease Type (Payment Structure, Term, Prepay Amount)
Costs (monthly payments, marginal costs, electricity rate)
End of Term Value

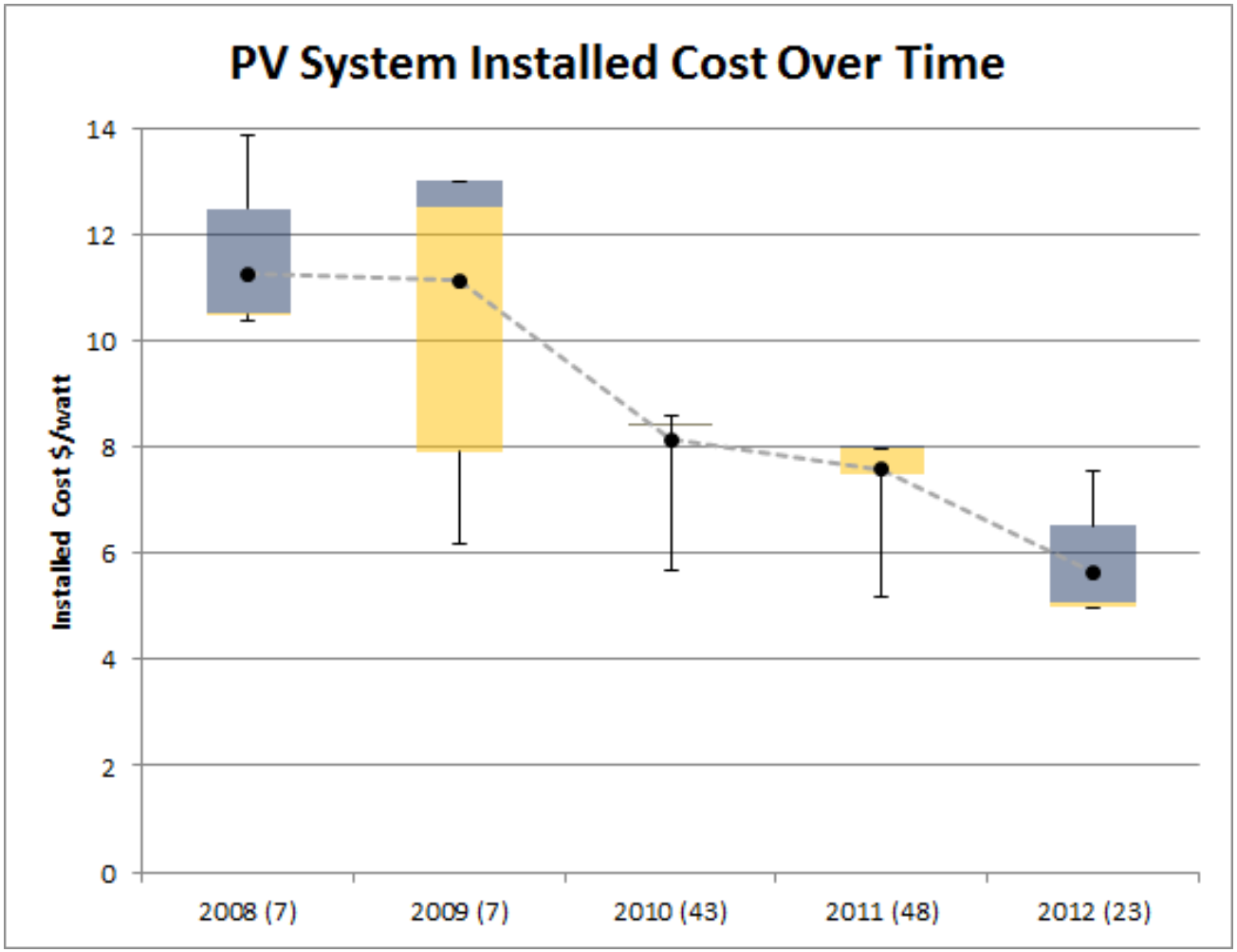
Cost Of Full Prepaid Lease Varies By Company, And Appears To Be Increasing Over Time





n = 48 (16% of usable)

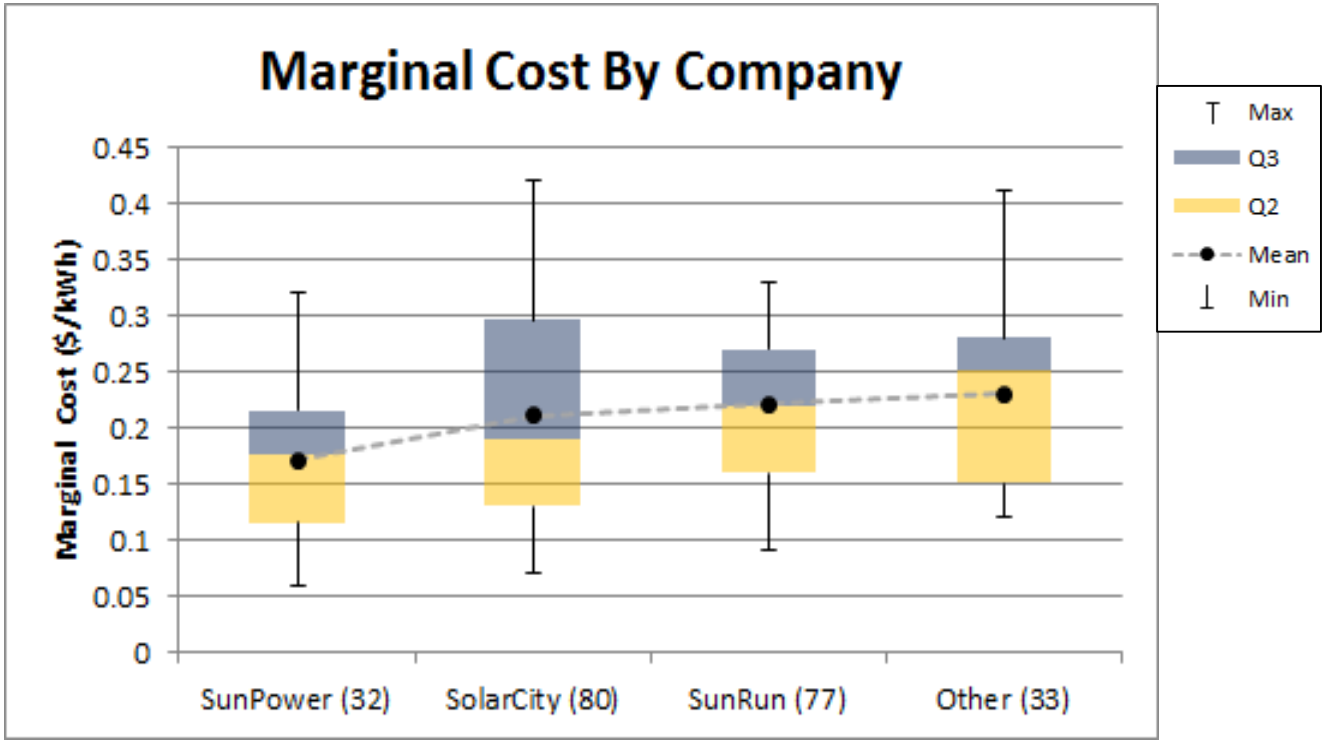
Installed Cost is Decreasing Significantly Over Time
(But Only 44% of Contracts Included Fair Market Value at Signing Date)



n = 128 (44% of usable)

There Is Not A Very Large Difference In Year 1 Marginal Cost Across Companies

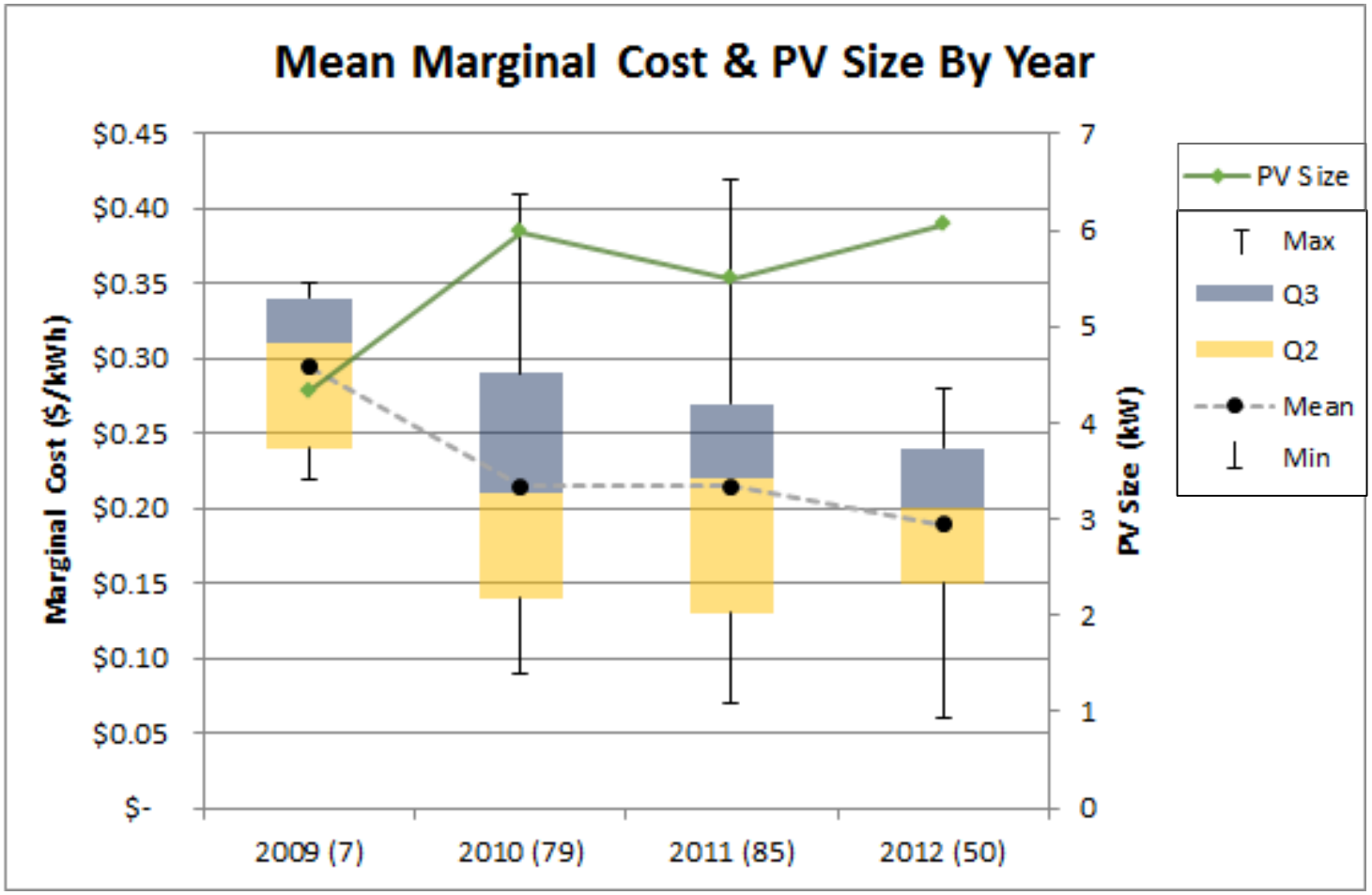
Company (n)	Mean $/kWh (Y1)
SunPower (32)	$0.23
SolarCity (80)	$0.21
SunRun (77)	$0.17
Other (33)	$0.22



n = 222 (75.5% of usable)

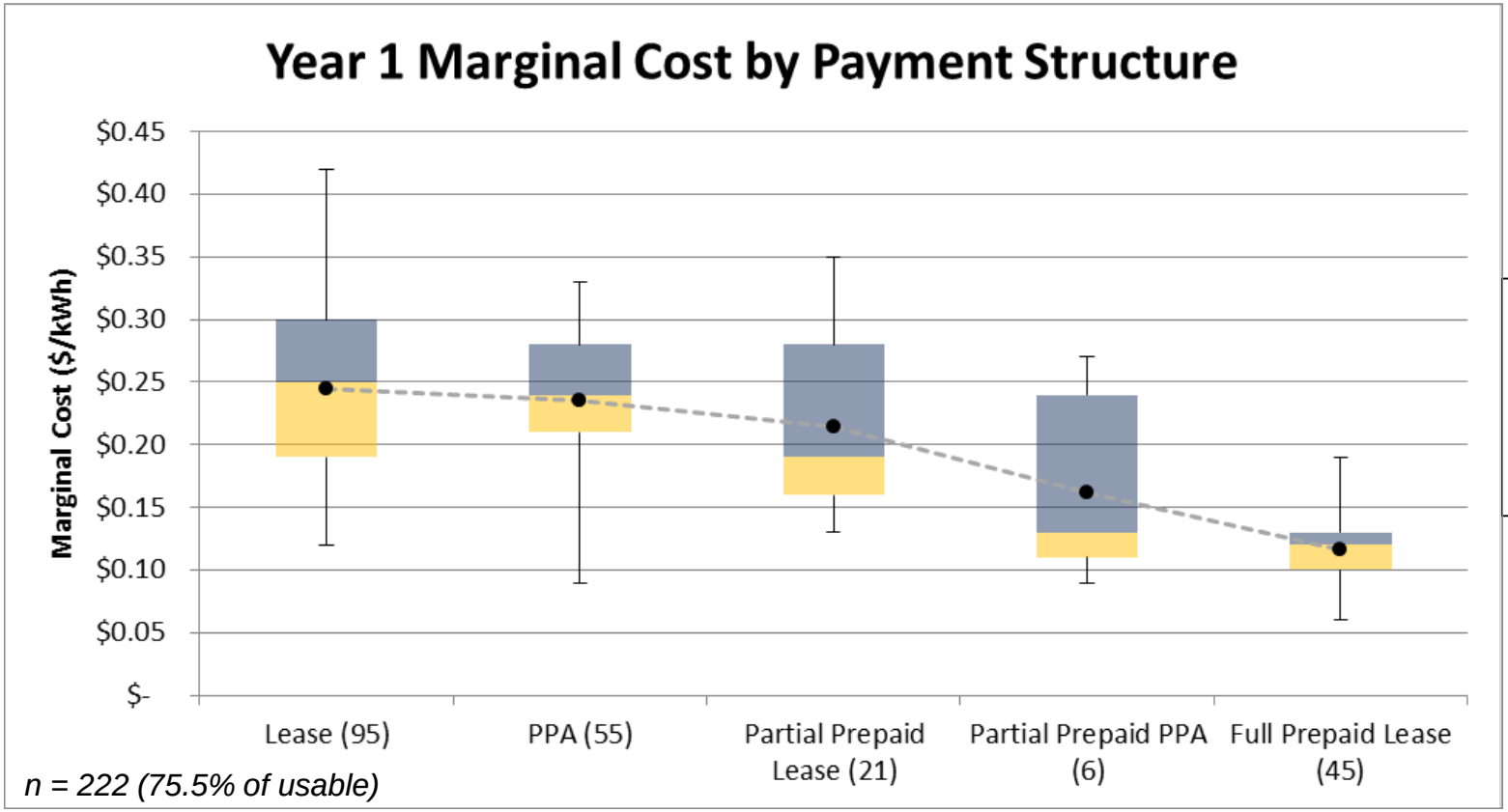
Year 1 Marginal Cost is here defined as the price of electricity per kilowatt-hour during the first year after installation. For a lease payment structure, marginal cost is estimated based on the fixed monthly cost divided by an estimate of monthly generation. For a PPA, marginal cost is simply the price paid (per kWh) by the customer to the provider.

Average Year 1 Marginal Cost Is Decreasing Over Time, Mirrored By Installed System Size



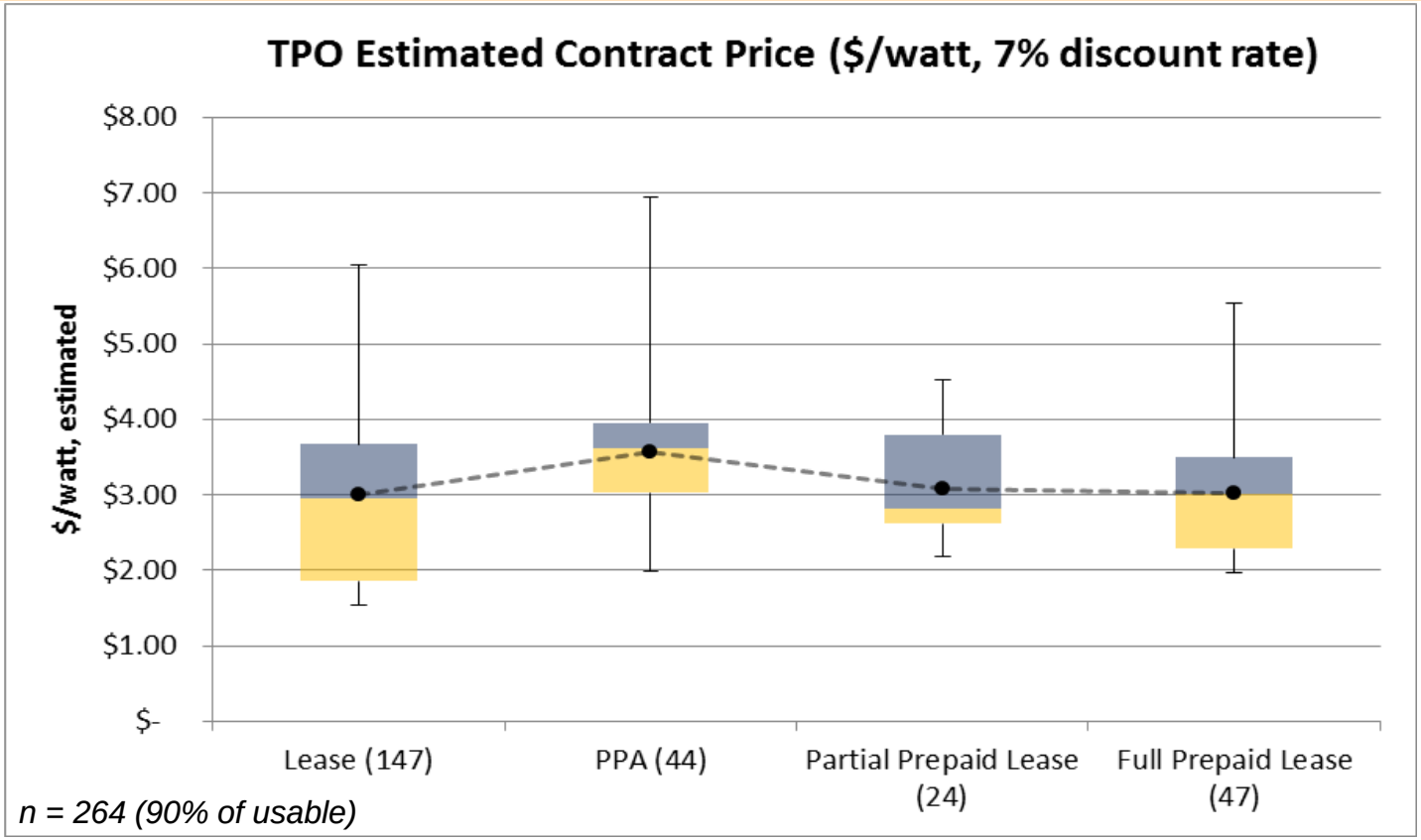
n = 221 (75% of usable)

Prepaid Leases Offer Lower Year 1 Marginal Cost



Year 1 Marginal Cost is here defined as the price of electricity per kilowatt-hour during the first year after installation. For a lease payment structure, marginal cost is estimated based on the fixed monthly cost divided by an estimate of monthly generation. For a PPA, marginal cost is simply the price paid (per kWh) by the customer to the provider. For prepaid leases, marginal cost is estimated based on the amount paid divided by the estimated total electricity generation over the life of the lease.

Estimated Real Contract Price Shows Little Variation Between Payment Structures



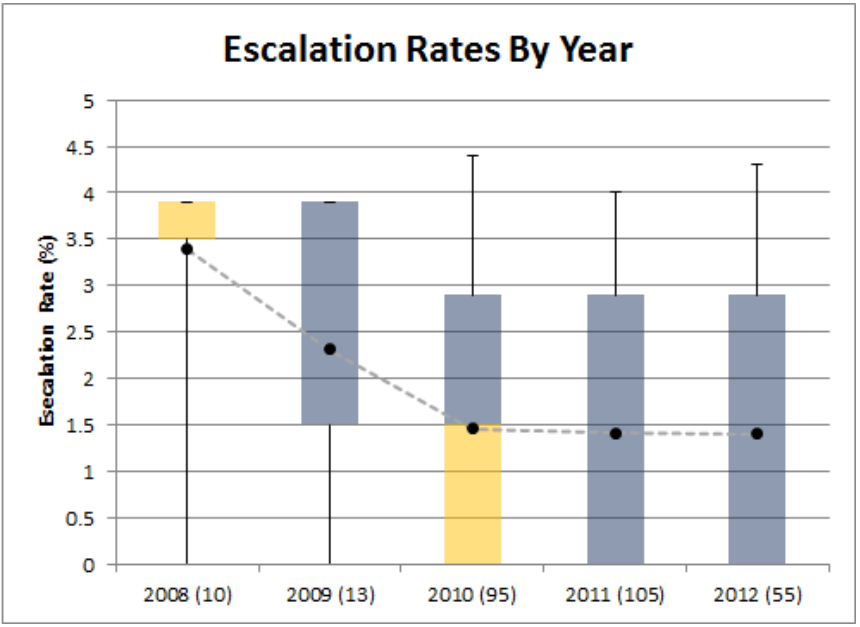
Real Contract Price was estimated using the formula:

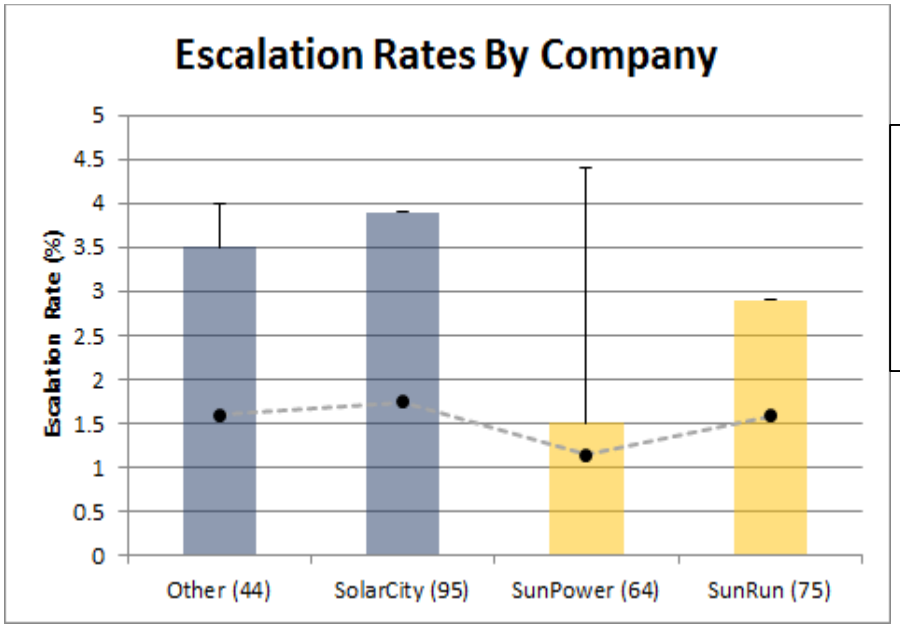
Real Contract Price ($/watt) = Upfront Payment + $\sum_{y=1}^{t}[(monthly\ payment\ *(1+e)^{y}*12\ )\ \div((1+d)^{y-1})]$

Where y is the contract year, e is the escalation rate, and d is the discount rate

Mean: $3.13 / watt

Escalation Rates May Be Declining Over Time, And Are Frequently <1.5% Annually

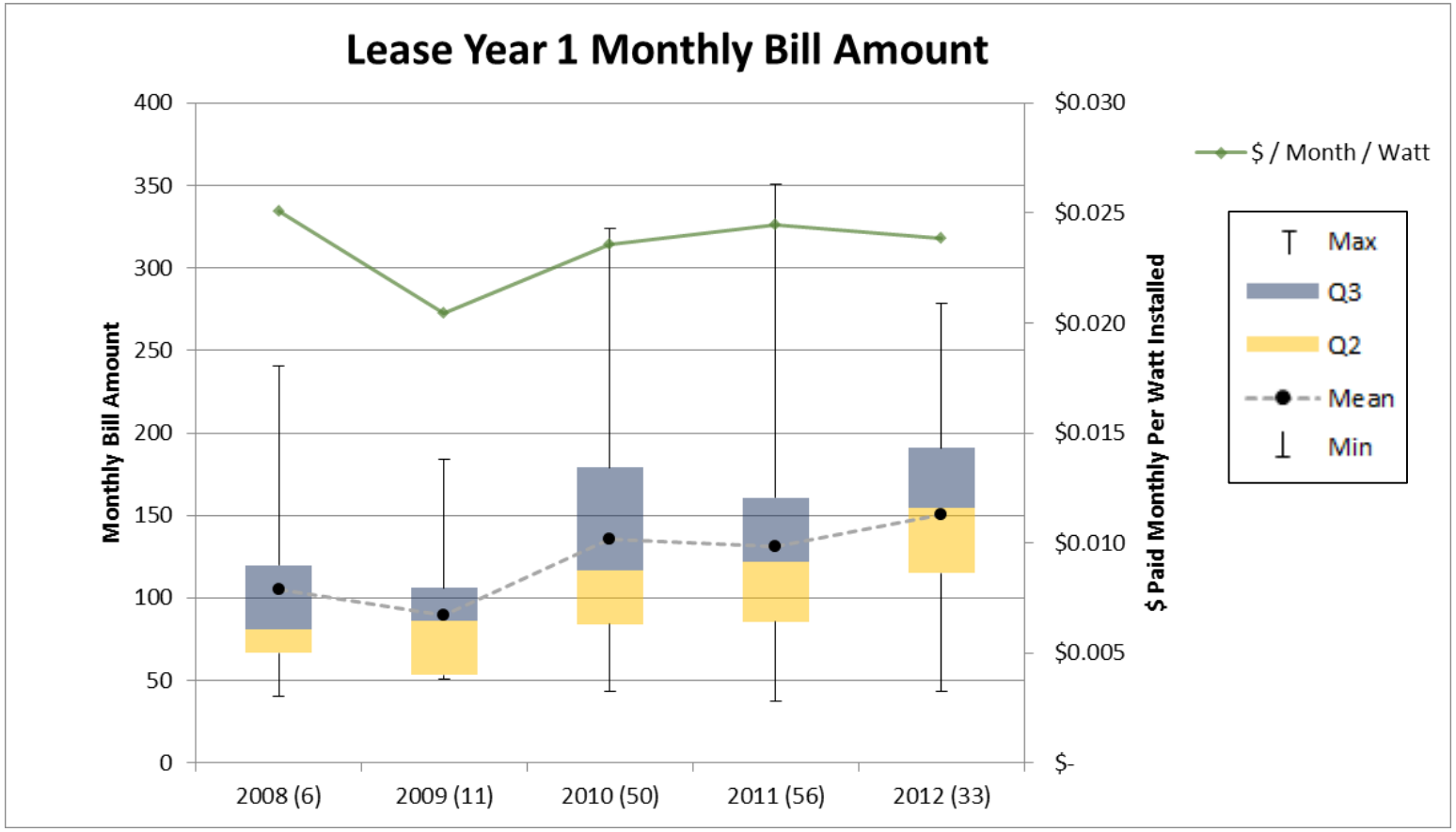




n = 278 (94.5% of usable)

For leases, escalation rate indicates the increase in fixed monthly cost from year to year. For PPAs, escalation rate refers to an annual increase in the marginal cost of electricity ($/kWh) paid by the customer.

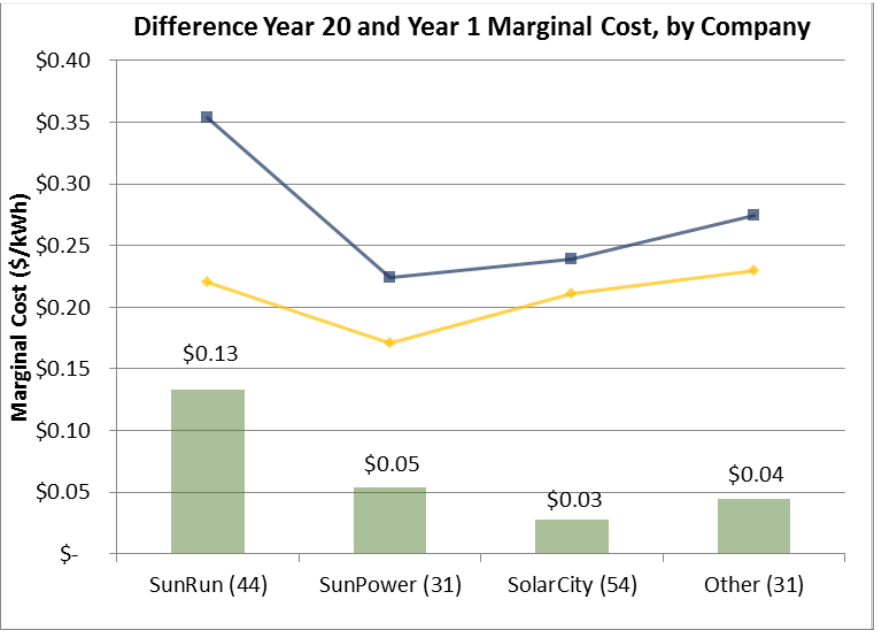
Average Monthly Bill Amount Is Increasing Over Time; Cost Per Month Per Watt Installed Is Relatively Flat

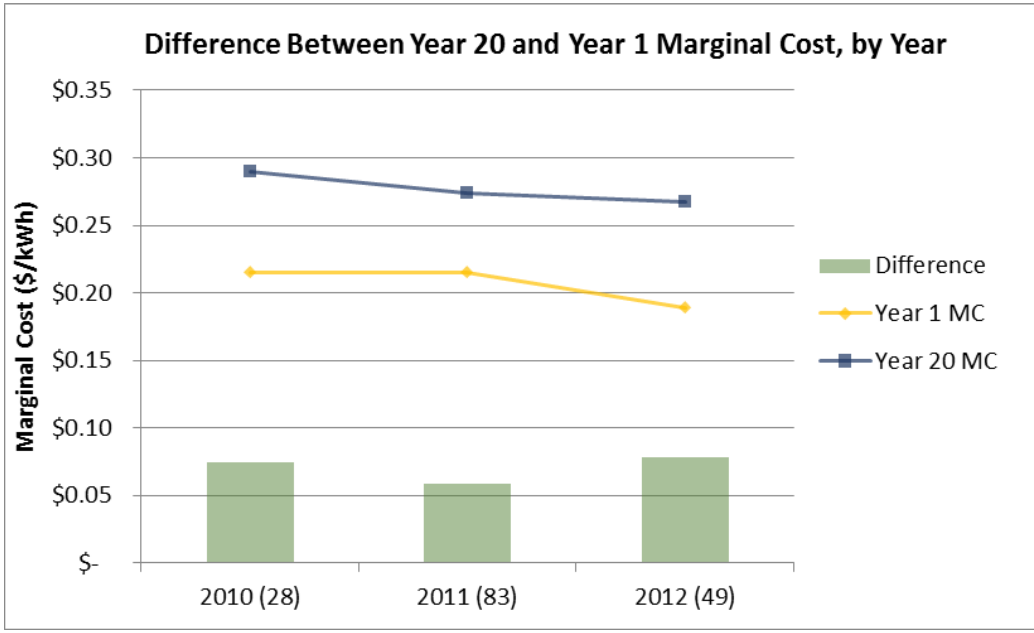


n = 156 (53.1% of usable)

For "Lease" payment structures only. PPAs and prepaid contracts not included in this analysis.

Difference Between Average Year 20 and Year 1 Marginal Cost Varies Across Companies, But Relatively Flat Over Time





n = 160 (54.4% of usable)

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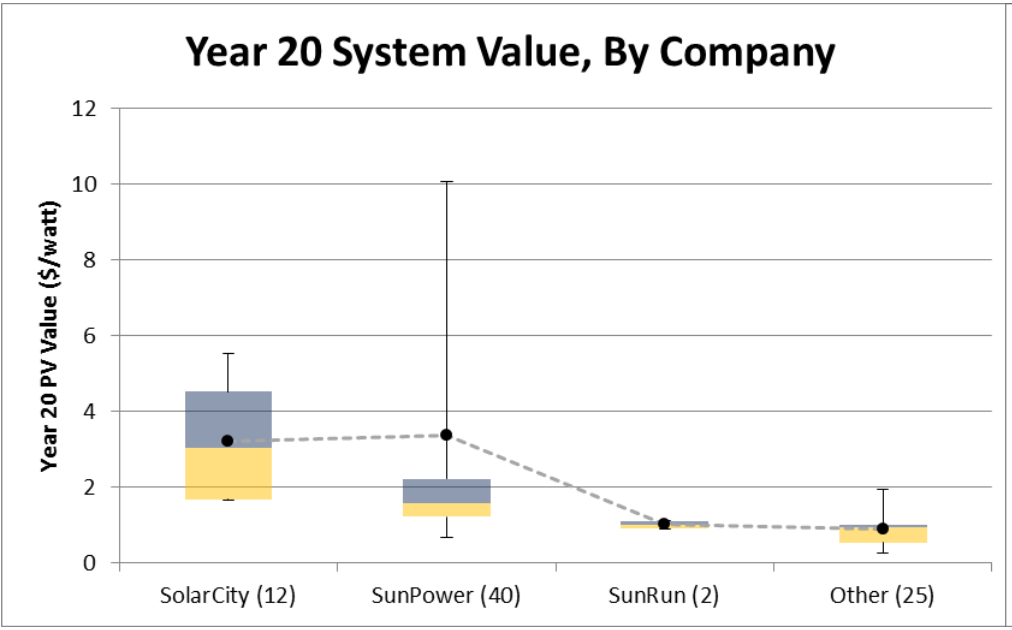
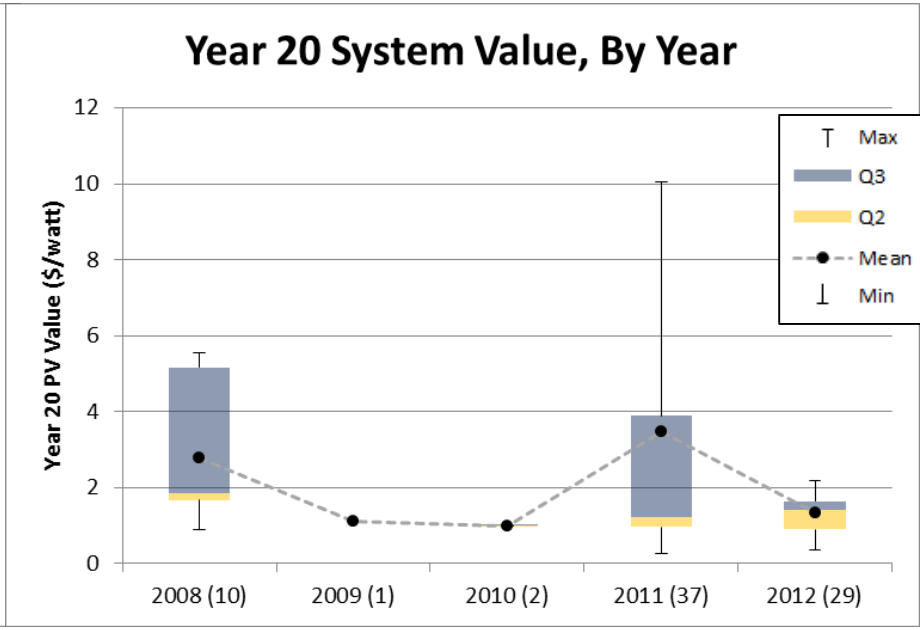
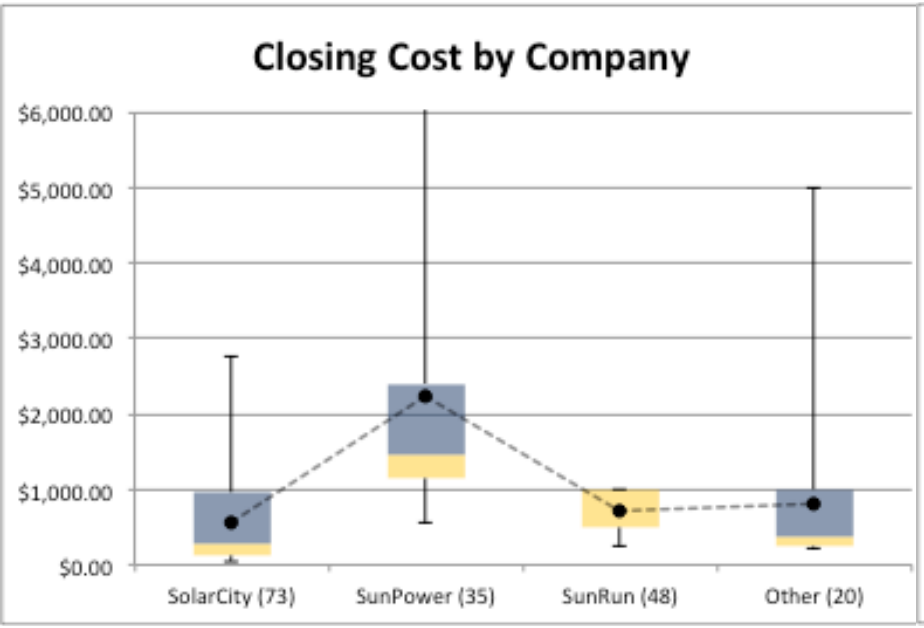
Estimated Value of System ($/watt) After 20 Years

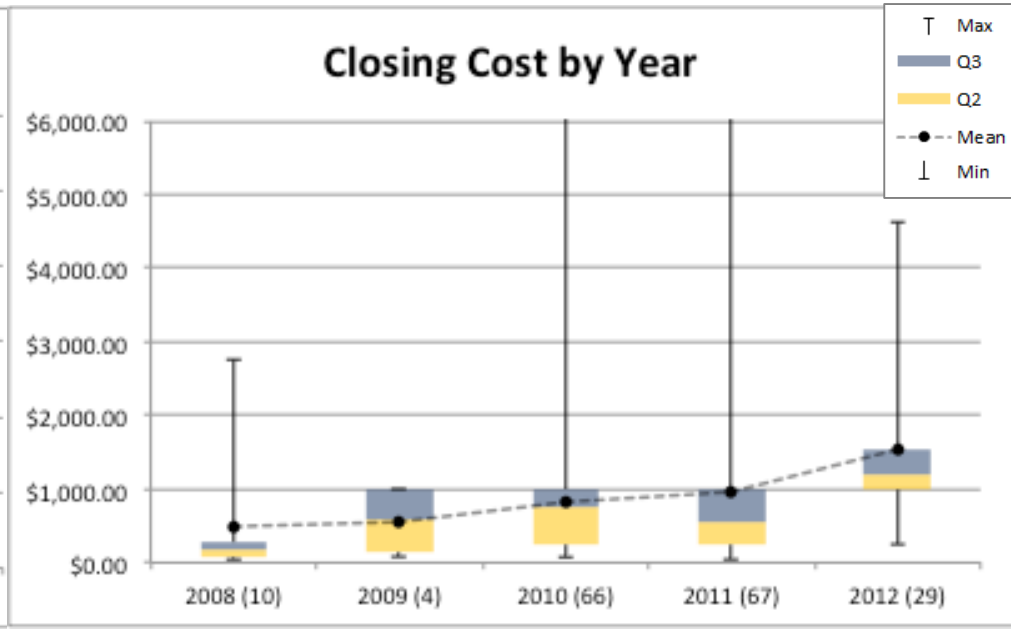




n = 79 (26.9% of usable)

Closing Costs Are Typically Under $1,000; May Be Increasing Over Time





n = 176 (59.9% of usable)

Conclusions

- Accessibility of data is spotty – especially for older contracts, but sample is representative of the population.
- 3 companies represented 83% of the market for the 294 contracts examined.
- TPO PV system size appears to be increasing slightly over time, is relatively consistent across companies, and is larger for existing homes than newly built homes.
- Leases are the dominant payment structure, but PPAs and Prepaid contracts, which appeared more recently, are also common.
- Installed cost of TPO PV systems ($/watt) is decreasing over time.
- Mean estimated real contract price across all contracts surveyed was only $3.13 per watt, which is comparable to the findings of Davidson et. al, 2014.
- Although on average leases have the highest year 1 marginal cost, they have the lowest estimated real contract price.
- There is a wide variation in remaining system value at Year 20.

Looking Forward

Based on our data **realtors** and **appraisers** should look out for:

- Sizes of TPO systems in the 5 to 6 kW range
- TPO systems that are as much as 13 years old, with many 7-8 years old.
- A large percentage of leases, but also prepaid and PPAs, with relatively high prepaid amounts
- Leases with lengths consistently at 20 years
- Significant closing costs for sellers that buyers will likely not want to cover

Thank You

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