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# Using Residential Solar PV Quote Data to Analyze the Relationship Between Installer Pricing and Firm Size

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## Summary

We use residential solar photovoltaic (PV) quote data to study the role of firm size in PV installer pricing. We find that large installers (those that installed more than 1,000 PV systems in any year from 2013 to 2015) quote higher prices for customer-owned systems, on average, than do other installers. The results suggest that low prices are not the primary value proposition of large installers.


## Context

The vast majority of U.S. residential PV installers are small local firms, yet PV sales are relatively concentrated in a few large firms; in 2015, the largest 10% of installers accounted for nearly 90% of residential systems installed, and the largest 1% of installers accounted for more than 60% of systems. What are the effects of this market concentration? Do large installers achieve economies of scale (lower costs with increasing volume) and offer lower prices to customers? Or can large installers use their size to exercise market power and charge higher prices?

## Data and Methods

Previous studies of the relationship between PV pricing and installer size have relied on installed system prices from a limited number of data sets. These studies control for price-determining factors such as system size and module efficiency. However, owing to data limitations, they do not control for customer-level factors such as roof characteristics and customer preferences.

As an alternative, our approach does not use installed-price data. Rather, we use 1,588 residential PV quotes from the third-party quote provider EnergySage to study the effects of installer size

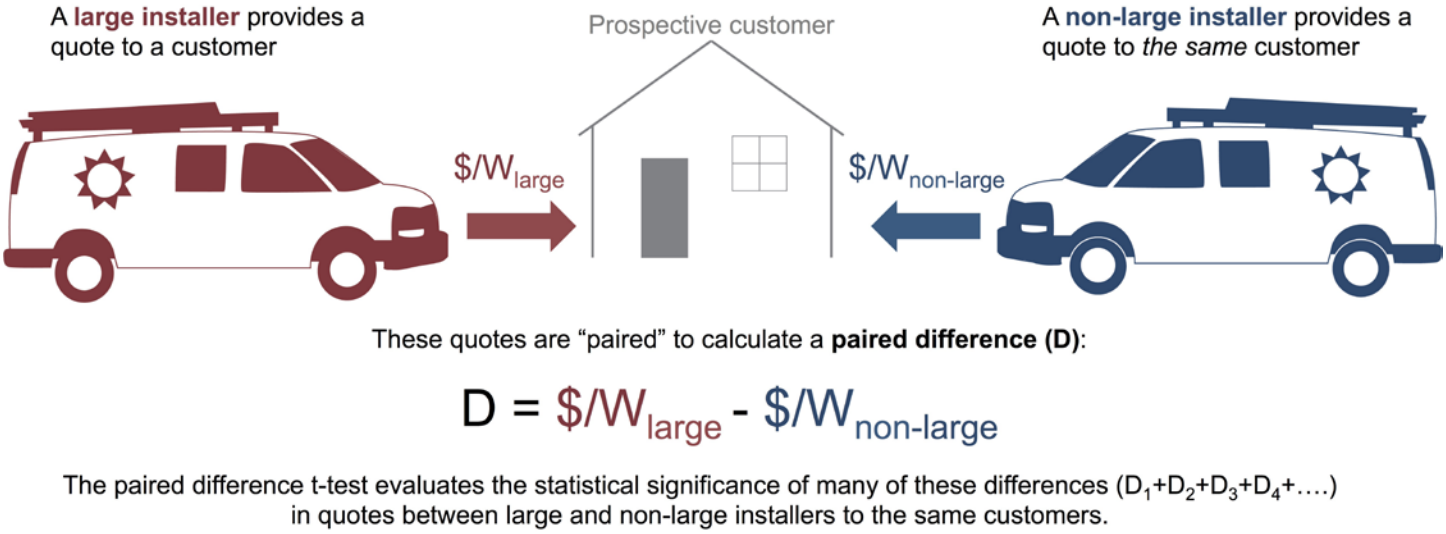


Figure 1. Schematic of the paired difference approach for analyzing PV quote data

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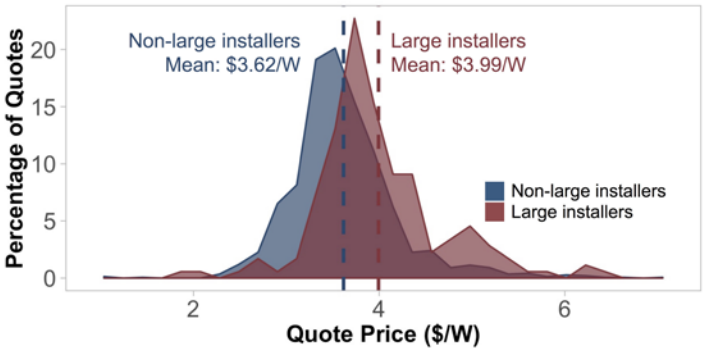
on price behavior. The data cover customer-owned systems quoted during 2014–2016 in 27 states and Washington, D.C.[1] We analyze the "paired differences" between price quotes made to the same customers by large and non-large installers (Figure 1). The advantage of this method is that customer and site characteristics remain constant across multiple quotes made to the same customer, so we can effectively control for otherwise unobservable customer- and site-level differences.

## Results and Conclusions

Within our entire data set, average large installer quotes are about $0.37/watt (W) higher than average non-large installer quotes (Figure 2, top). When we analyze only the differences between paired systems, we find that large installer quotes are $0.33/W (about 10%) higher, on average, than non-large installer quotes offered to the same customer (Figure 2, bottom). The difference falls to about $0.21/W after controlling for systematic differences between large and non-large installer quotes, but it remains statistically significant. Large installers offered a higher quote price than a corresponding non-large installer in about 70% of pairings.

**Quote Price Distributions**




**Paired Difference Distribution**

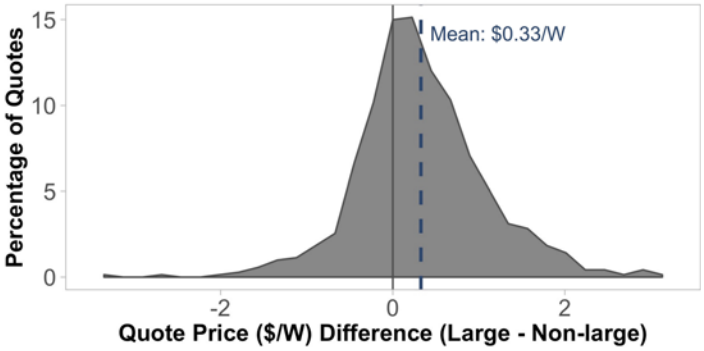



Figure 2. Quote price distributions for full dataset of non-large and large installers (top) and paired difference distribution (bottom)

Our results suggest that low prices are not the primary value proposition of large installer systems. The findings may support several hypotheses:

- Large installers might charge higher prices due to imperfect competition in the customer quote-collection process.
- Large installers might incur increasing costs as they install increasing volumes of PV systems, with the diseconomies of scale driving higher prices.
- Higher large installer prices may reflect the reputational values that prospective customers attribute to large installers, such as perceptions of superior contractual performance.
- Higher customer-owned system prices could suggest that large installers compete with lower prices through other ownership models, such as leases and power-purchase agreements.

Our study corroborates previous findings that firm size and market structure affect PV prices, and it suggests that increased price transparency and customer education may promote price reductions. Some residential PV customers may forego lower prices in favor of the perceived advantages of working with large installers. However our results suggest that customers could achieve lower prices by obtaining multiple quotes from large and non-large installers before deciding to install a system.

## More Information

For more information, download the full technical report: O'Shaughnessy, Eric, and Robert Margolis. 2017. *Using Residential Solar PV Quote Data to Analyze the Relationship Between Installer Pricing and Firm Size*. NREL/TP-6A20-68010. Golden, CO: National Renewable Energy Laboratory. *http://www.nrel.gov/docs/fy17osti/68010.pdf*

For questions, contact Eric O'Shaughnessy at *Eric.OShaughnessy@nrel.gov*.

1. We exclude quotes for third-party ownership arrangements such as leases and power-purchase agreements, which constituted about 5% of quotes in the original data set.
2. We use a linear regression model to control for system size, quote date, module efficiency, whether the quote included a micro-inverter or DC optimizer, and whether the quote was delivered through EnergySage.

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