Thank you for taking the time to complete the National Solar Database survey. Your responses will help SEIA as it advocates for policies that will help move the solar industry forward across the country.

As a token of our appreciation, attached below is a copy of the U.S. Solar Market Insight 2013 Year in Review full report, published by SEIA and GTM Research. This issue sold for $3,995 when released in March 2014 and now it is yours free of charge. Please do not share this link with anyone outside your company.

SEIA and GTM Research release new reports every quarter with the best information available on national and state activity in the U.S. solar energy industry.

If you are not already a member of SEIA, please visit http://www.seia.org/member-center or email membership@seia.org to learn more about how joining SEIA can help your solar business grow.

Best Regards,

Thomas P. Kimbis
Vice President, Executive Affairs
Solar Energy Industries Association

Q2 Q3 Q4 Q4 Q3 Q2 Q1 Q1 Q2 Q3 Q4 Q3 Q2 Q1 Q1 Q2 Q3 Q4 Q4 Q3 Q2 Q1
Q3 Q2 Q1 Q1 Q2 Q3 Q4 Q4 Q3 Q2 Q1 Q2 Q3 Q4 Q4 Q3 Q2 Q1 Q1 Q2 Q3 Q4

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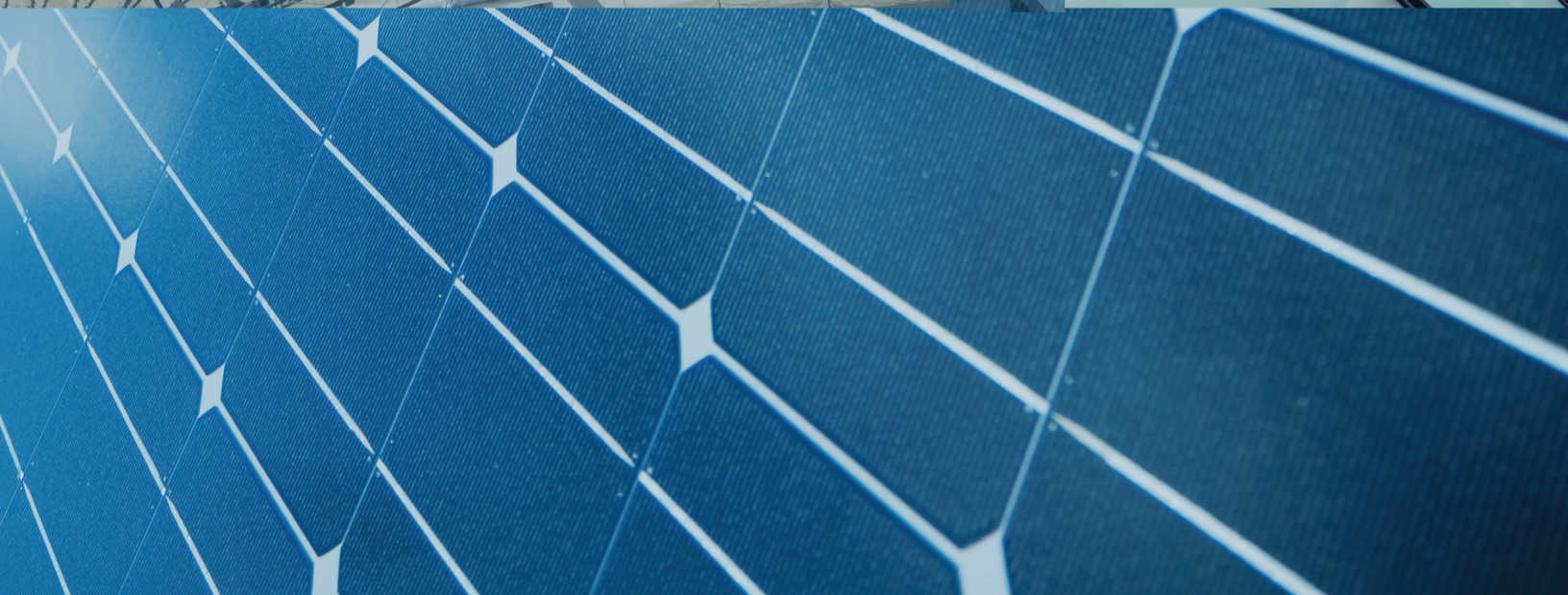
U.S. SOLAR MARKET INSIGHT

REPORT | 2013 YEAR-IN-REVIEW | FULL REPORT



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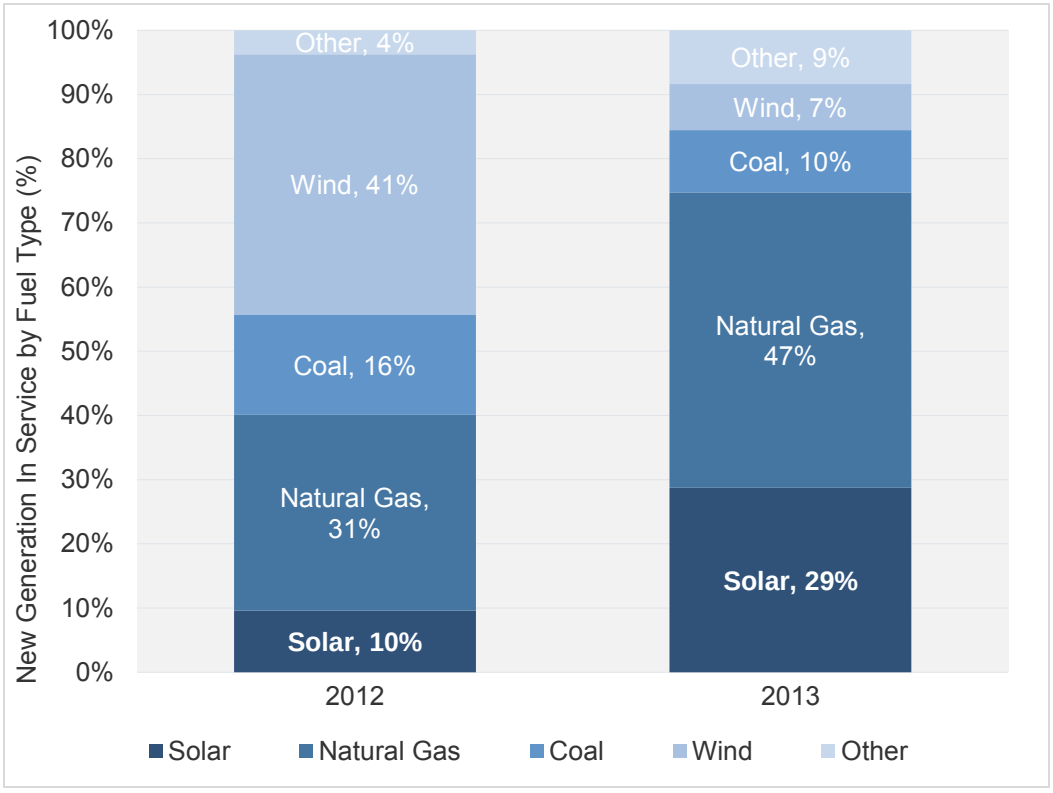
1. Introduction

The U.S. solar industry has much to celebrate about the year 2013. Photovoltaic (PV) installations continued to proliferate, increasing 41% over 2012 to reach 4,751 MW. Solar was the second-largest source of new electricity generating capacity in the U.S., exceeded only by natural gas. And the cost to install solar fell throughout the year, with average system prices ending the year 15% below the mark set at the end of 2012.

Figure 1.1 New U.S. Electricity Generation Capacity, 2012 vs. 2013



Source: GTM Research, FERC

Note: FERC Energy Infrastructure Update report used for all technologies other than solar. SMI data on PV and CSP used for solar and converted to MWac using a 0.87 DC-to-AC derate factor

The U.S. solar market showed the first real glimpse of its path toward mainstream status in 2013. The combination of rapid customer adoption, grassroots support, improved financing terms, and public market successes brought clear gains for solar in the eyes of both the general public and the investment community. And in the long term, a mainstream solar industry will need both customers who seek out and support solar, as well as investors who see an attractive risk-adjusted opportunity in the market.

The solar industry also became a key part of a much larger discussion that took center stage in 2013 around the future of electricity and electric utilities. As distributed solar gains steam, and as

adjacent technologies such as energy storage become economically viable, the traditional utility business model is increasingly called into question. Throughout the electricity industry, 2013 was the year of catchphrases such as "utility 2.0" and "utility of the future." Utilities themselves began to stake out positions on all sides of the issue, some protecting their current territory and others investing in distributed generation.

But if 2013 was about raising the issue, 2014 will be about defining solutions. Increasingly, solar is not bound by its cost but rather by its role in the electricity sector. And as solar continues along its path toward mainstream status, its integration with the broader electricity market from a technical, market and regulatory perspective will become the most important issue in the industry.

Additional highlights from the 2013 in the U.S. solar market:

- **Positive Early Signs in NEM Debates:** Disputes between utilities and solar advocates emerged over the issue of net energy metering (NEM) across a variety of markets ranging from major solar states (e.g., California, Colorado and Arizona) to states with more nascent solar markets (e.g., Utah, Idaho, Louisiana and Georgia). Broadly speaking, the solar market has remained unscathed thus far. But the next two years will bring both new venues for NEM debates and longer-term decisions in the existing battlegrounds.
- **Financial Innovation**: After years of discussion and speculation, a number of new financing mechanisms for solar emerged in 2013. NRG Energy took its first YieldCo public, generating a tradable, dividend-producing security that encompasses both utility-scale and rooftop solar projects, as well as fossil fuel assets. SolarCity successfully launched the first distributed solar securitization, worth $54 million. And opportunities for consumers to invest in solar via crowdfunding or community solar gained new prominence.
- **Cost Reductio**n: PV module prices increased slightly in 2013, the first annual price increase since 2008. However, prices fell substantially for other components such as inverters (which decreased by 15% to 18%) and racking systems (19% to 24%). In addition, a range of other factors including downstream innovations drove down overall system prices throughout the year in all market segments. By the end of the year, system prices had fallen 9% in the residential market, 16% in the non-residential market and 14% in the utility market.
- **A New U.S.-China Trade Case**: On December 31, 2013, SolarWorld Industries filed a new antidumping/countervailing duty petition before the U.S. International Trade Commission. This petition seeks to prevent Chinese module manufacturers from using Taiwanese crystalline PV cells to avoid paying the import tariffs on modules with Chinese cells that were imposed after SolarWorld's initial petition, filed in October 2011. Under the previous ruling, Chinese module manufacturers can produce solar wafers in China, ship them to Taiwan for cell manufacturing, and then send them back to China for module assembly to avoid U.S. import tariffs of more than 30%. While the outcome of this case remains in question, it is likely to reshape the U.S. solar market in some fashion. (More details will be offered in subsequent sections of the report, or visit www.seia.org/policy/manufacturing-trade/international-trade.

- **California Sees Unparalleled Growth:** California alone installed more than half of all solar in the U.S. in 2013. In fact, the state installed more solar in 2013 than the entire country did in 2011. California led the pack in each market segment and saw a doubling of installations in both the residential and utility segments. Looking to 2014, California shows no signs of slowing down, particularly in the distributed generation market.
- **The Ascent of North Carolina, Massachusetts, and Georgia**: While New Jersey, historically the second-largest state solar market, faltered in 2013, three states in particular emerged to fill the gap. North Carolina grew 171% over 2012 to install 335 MW, Massachusetts grew 76% to install 237 MW, and Georgia grew 762% to install 91 MW in 2013.
- **The Promise of Centralized Solar Is Realized**: The U.S. installed 2.8 GW of utility solar in 2013, up 58% over 2012. Eleven individual projects of more than 50 MW each were completed in 2013, more than in any other year. Together, Arizona, California, and North Carolina accounted for 87% of all utility PV installations.

1.1. Key Figures

- The U.S. installed 4,751 MW of solar PV in 2013, up 41% over 2012 and nearly fifteen times the amount installed five years earlier.
- There is now a total of 12.1 GW of PV and 918 MW of CSP operating in the U.S.
- There were nearly 140,000 individual solar installations in the U.S. in 2013, and a total of over 440,000 systems operating today.
- Q4 2013 was by far the largest quarter ever for PV installations in the U.S., up 60% over the second-largest quarter (Q4 2012).
- More solar has been installed in the U.S. in the last eighteen months than in the 30 years prior.
- The market value of all PV installations completed in 2013 was $13.7 billion.
- Solar accounted for 29% of all new electricity generation capacity in 2013, up from 10% in 2012. This made solar the second-largest source of new generating capacity behind natural gas.
- The top five states (California, Arizona, North Carolina, Massachusetts, and New Jersey) accounted for 81% of all PV installations in 2013. The top twenty states accounted for 98% of all installations.
- We expect growth in all market segments in 2014: residential (47%), non-residential (40%) and utility (15%).
- Weighted average PV system prices fell 15% in 2013, reaching a new low of $2.59/W in the fourth quarter.
- The wave of CSP installations slated for completion in 2013-2014 began with the 280 MWac Solana project and the Genesis Solar project's initial 125 MWac phase. In early 2014, BrightSource's notable Ivanpah project also began operation.

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This quarter, we have added two states to our analysis: Indiana and Virginia. Our coverage in the U.S. Solar Market Insight reports now includes 30 individual states and Washington, D.C. However, the national totals reported include all 50 states, Washington, D.C., and Puerto Rico.

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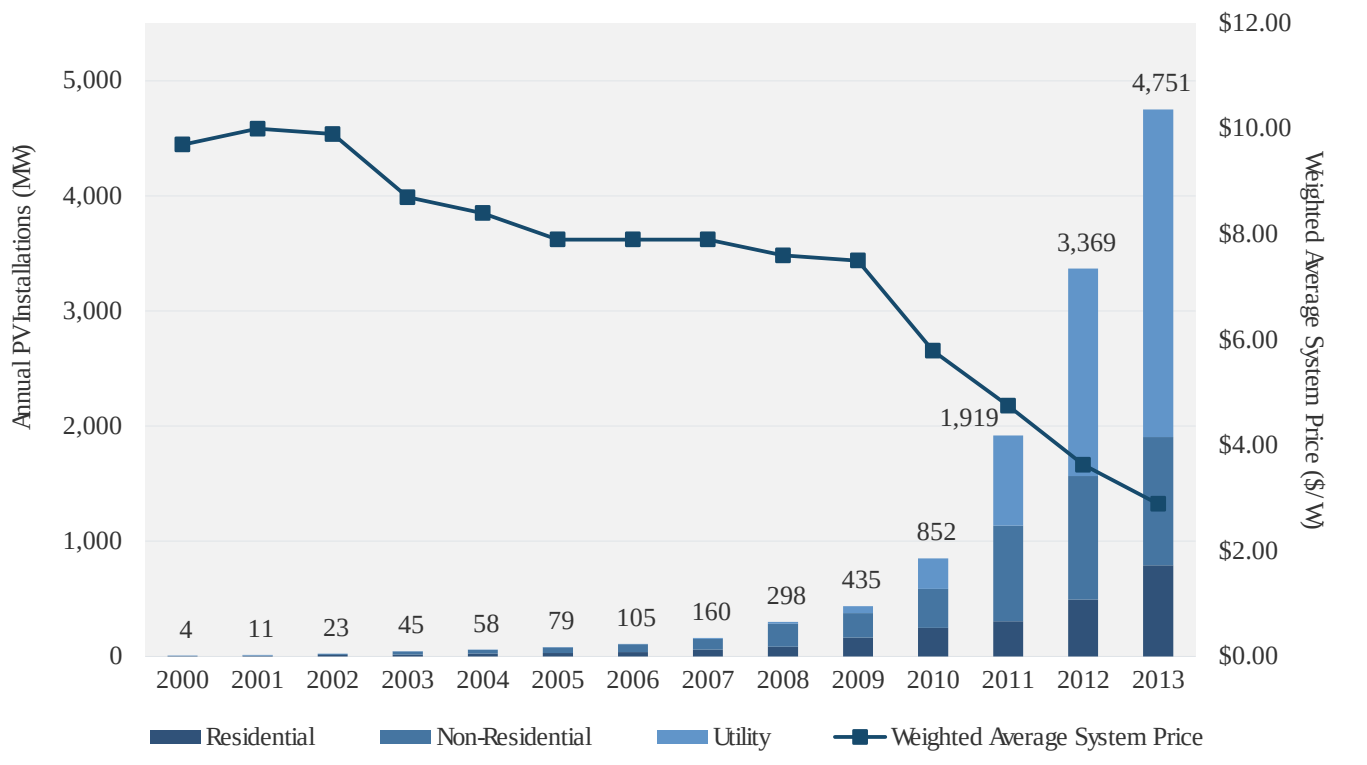
2. Photovoltaics

2.1. Installations

The U.S. installed 4,751 MW of PV in 2013, up 41% over 2012. Annual weighted average PV system prices continued to decline in 2013, reaching a historic low of $2.89/W.

Figure 2.1 U.S. PV Installations and Average System Price, 2000-2013



Installations (MW)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Residential	1	5	11	15	24	27	38	58	82	164	246	304	494	792
Non-Residential	2	3	9	27	32	51	67	93	200	213	339	831	1,072	1,112
Utility	0	3	2	3	2	1	0	9	16	58	267	784	1,803	2,847
Total	4	11	23	45	58	79	105	160	298	435	852	1,919	3,369	4,751

Sources: GTM Research/SEIA and Lawrence Berkeley National Laboratory

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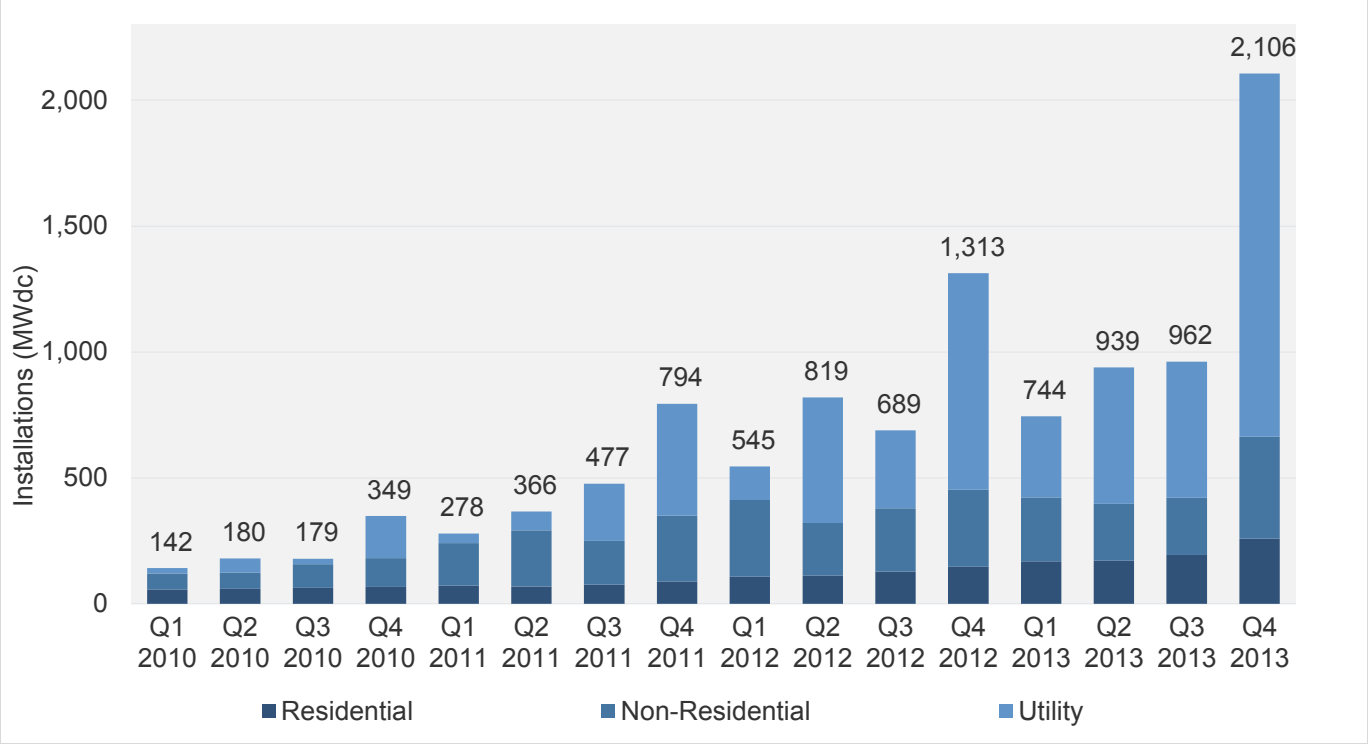
Of the 4,751 MW installed in 2013, 2,106 MW (44%) came in the fourth quarter. This makes Q4 2013 by far the largest quarter in the history of the U.S. market, exceeding the next largest quarter by 60%. This end-of-year boom came from all market segments, but was particularly strong in the utility market, which saw over 1.4 GW installed across fifteen states in Q4.

Figure 2.2 U.S. PV Installations by Quarter, Q1 2010-Q4 2013



2.1.1. Seasonal Trends

The fourth-quarter boom experienced in 2013 is a pattern consistent with previous years. The U.S. market tends to see a significant jump in installations at the end of the year, regardless of whether there are major incentives expiring. This seasonality held true in the distributed generation market, where 35% of all 2013 installations took place in Q4, but it has been particularly pronounced in the utility market, where 51% of annual installations were completed in Q4.

Figure 2.3 Utility Solar Installations by Quarter

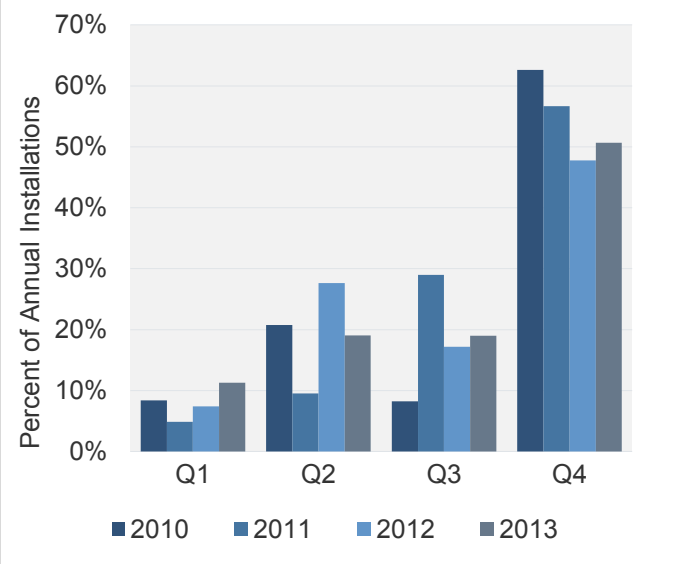
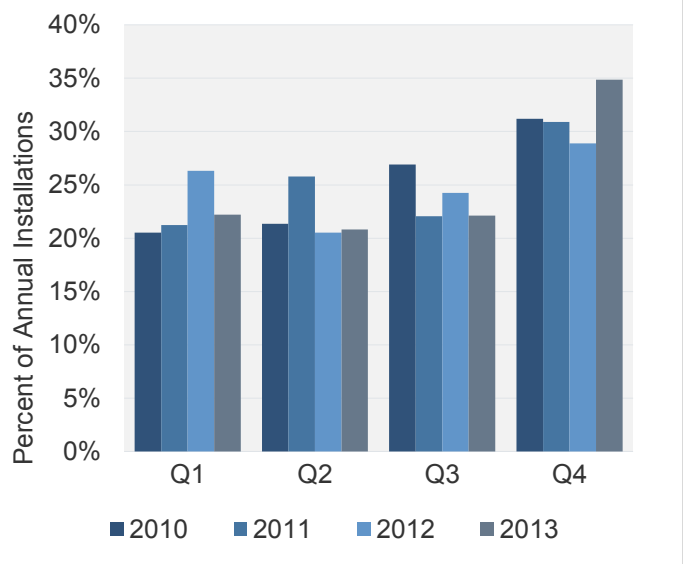
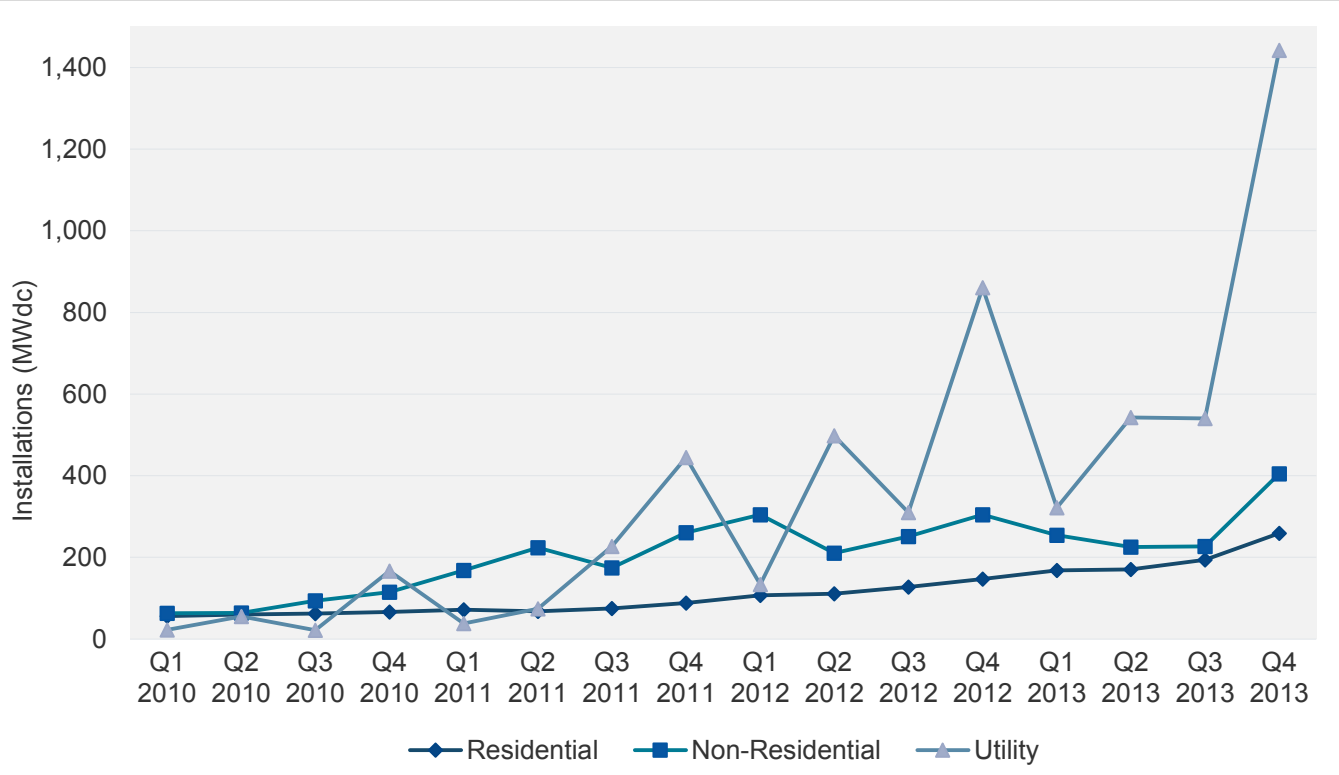


Figure 2.4 Customer-Sited Solar Installations by Quarter



2.1.2. Market Segment Trends

Figure 2.5 Quarterly PV Installations by Market Segment, Q1 2010-Q4 2013



	Q1 2010	Q2 2010	Q3 2010	Q4 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Residential	56	60	63	67	72	68	75	88	107	111	128	147	168	171	194	259
Non-Residential	63	64	94	115	168	224	175	261	305	210	251	305	255	226	227	405
Utility	22	55	22	167	38	75	227	445	134	498	310	861	322	543	540	1,442
Total	142	180	179	349	278	366	477	794	545	819	689	1,313	744	939	962	2,106

Residential

Key Figures

- 792 MW installed in 2013, representing 60% annual growth
- 259 MW installed in Q4 2013, up 33% over Q3 2013, and by far the largest quarter ever for the segment

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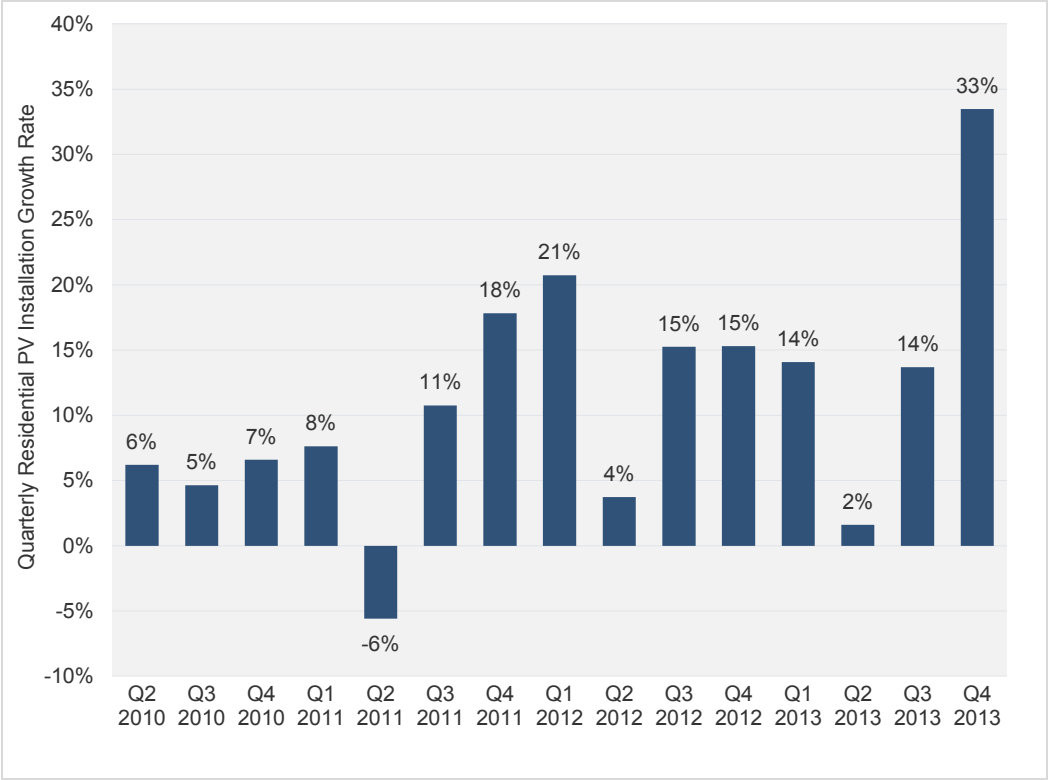
The U.S. residential solar market has been distinguished over the past three years by its remarkably consistent incremental growth. On a national level, residential solar has steadily gained steam as homeowner financing options (leases, loans, and PPAs) proliferate, system costs continually decline, and market participants innovate. Some of the most impactful developments in 2013 included:

- **Evolving Channel Strategies** – Residential solar installers and originators spent much effort in 2013 honing their strategies to reach customers. Some announced new retail partnerships (such as with brands like Home Depot and Toyota), while others linked up with electricity retailers or local service professionals. We expect to see further diversification of sales channels in 2014, including a number of new partnerships with electricity suppliers, the entry of cable and other home service providers, and potentially an increased role for local banks in solar sales.
- **Financial Innovation** – Though its immediate impact is small, the long-term impact of SolarCity's first securitization of distributed solar assets is likely to be huge. Securitizing pools of residential solar assets can both lower the cost of capital and increase its availability – removing two of the primary historical barriers to growth in the residential sector. In 2014, another residential system owner will almost certainly securitize its own portfolio, and, if all goes according to plan, yields on these pools will begin to decrease.

But most notable about 2013 was the Q4 boom, in which installations jumped 33% over the previous quarter – the largest quarterly increase in recent history.

Figure 2.6 Quarterly Residential PV Growth Rate, 2010-2013



This year-end jump, and indeed much of the annual growth, is attributable primarily to California. While the California market has always been the largest for residential solar, its importance has only grown over time, with its market share of national installations increasing from 43% in Q1 2010 to 55% in Q4 2013. As we have noted previously, California is the first major solar market to successfully transition away from state-level incentives. By all accounts, the residential solar market in California shows no signs of slowing down in the near term, at least until final decisions are made regarding net energy metering and rate design.

We expect another strong year for the residential market in 2014 both in California and other states, ultimately resulting in 47% annual installation growth and a residential market that reaches nearly 1.2 GW.

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Figure 2.7 Residential PV Installations, California vs. Rest of U.S., 2010-2013

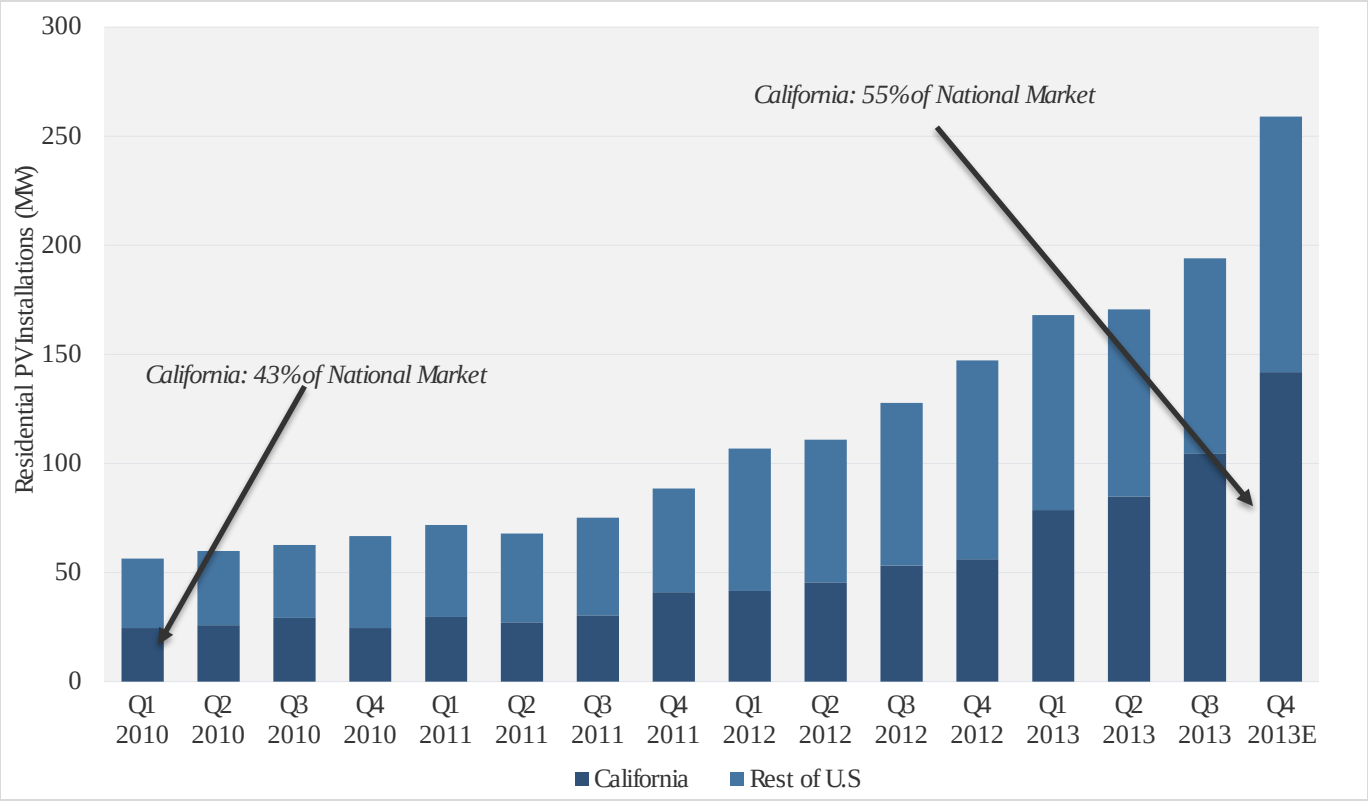

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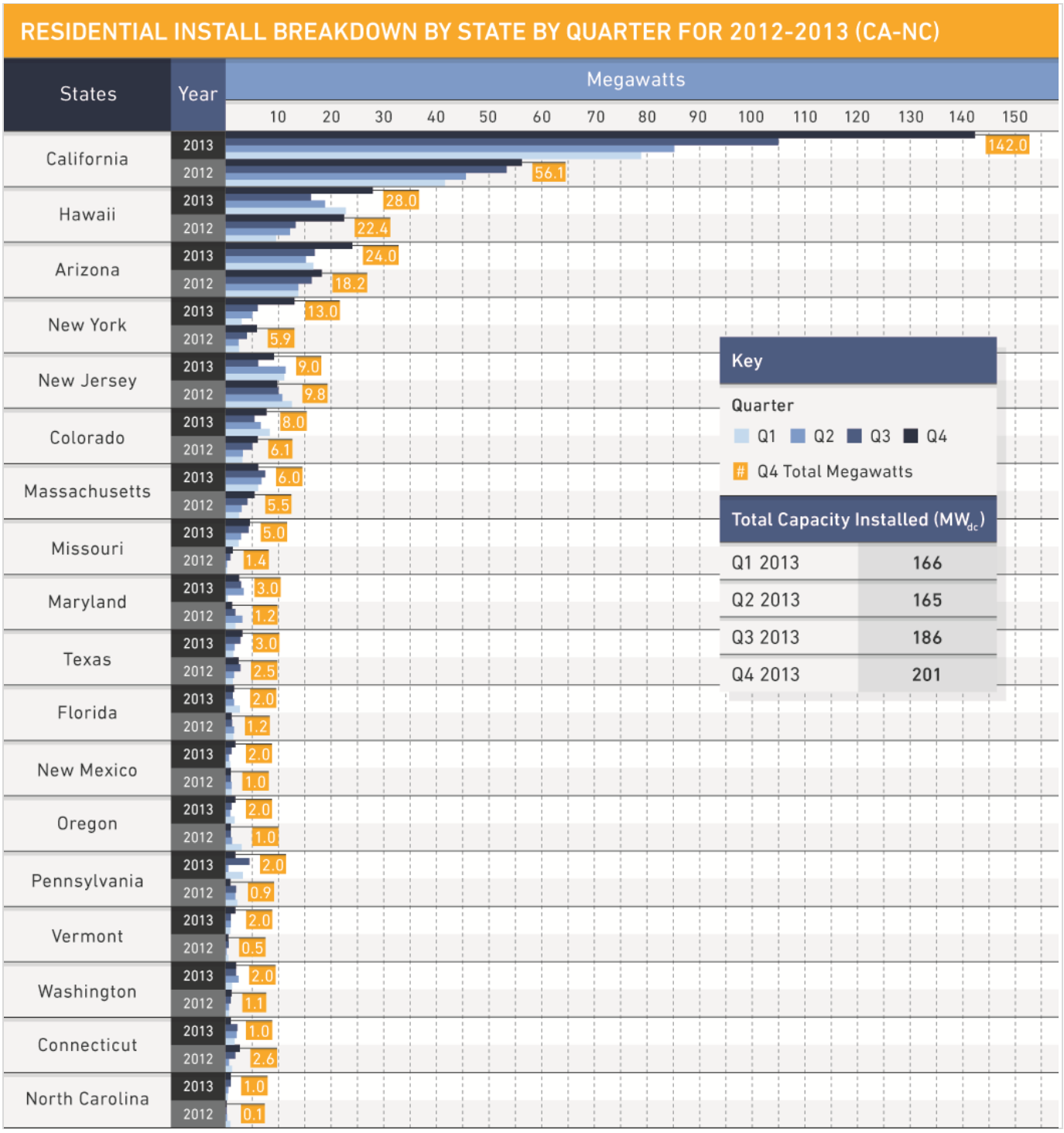
Figure 2.8 Residential PV Installation Breakdown by State, 2012-2013



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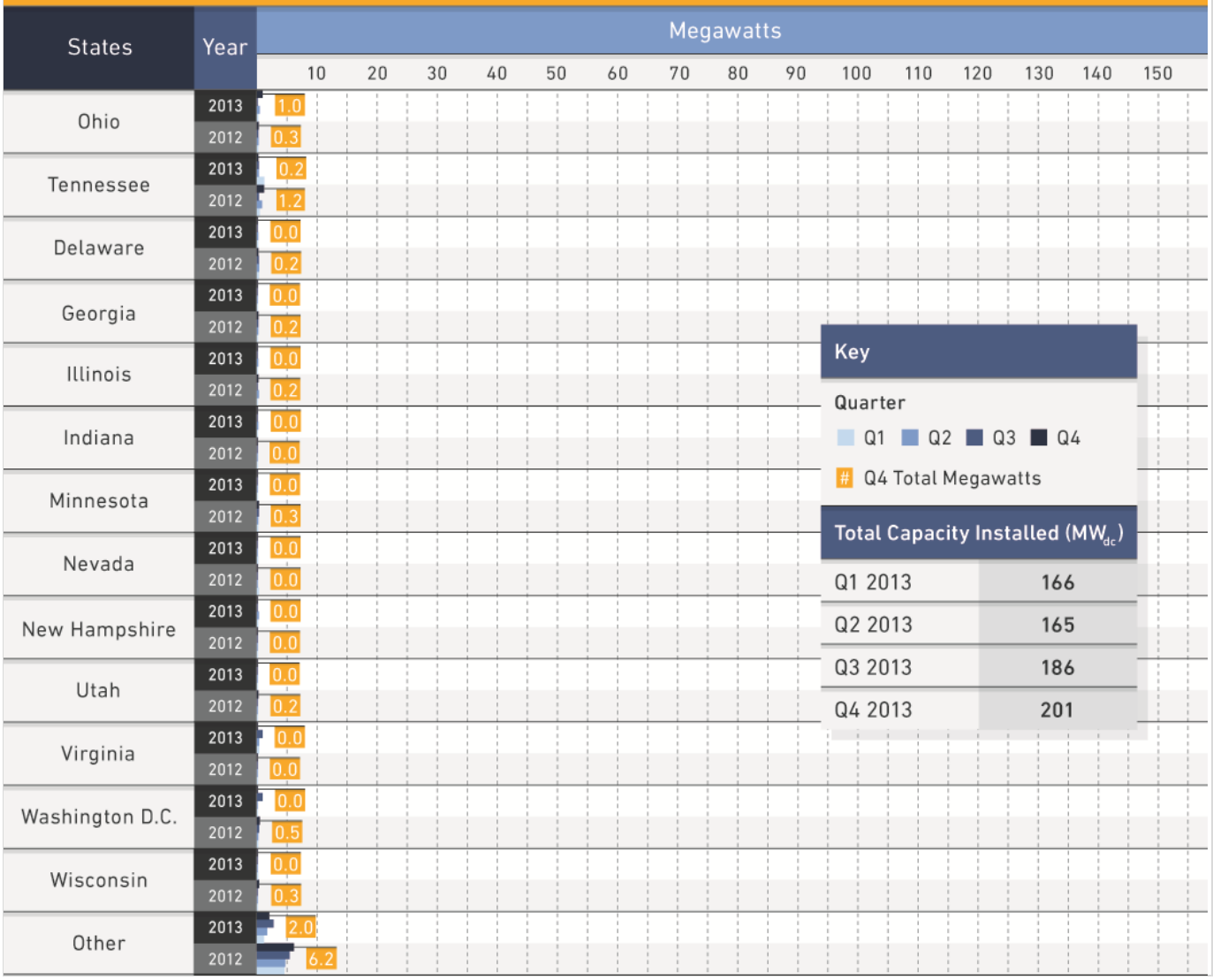
RESIDENTIAL INSTALL BREAKDOWN BY STATE BY QUARTER FOR 2012-2013 (OH-OTHER)



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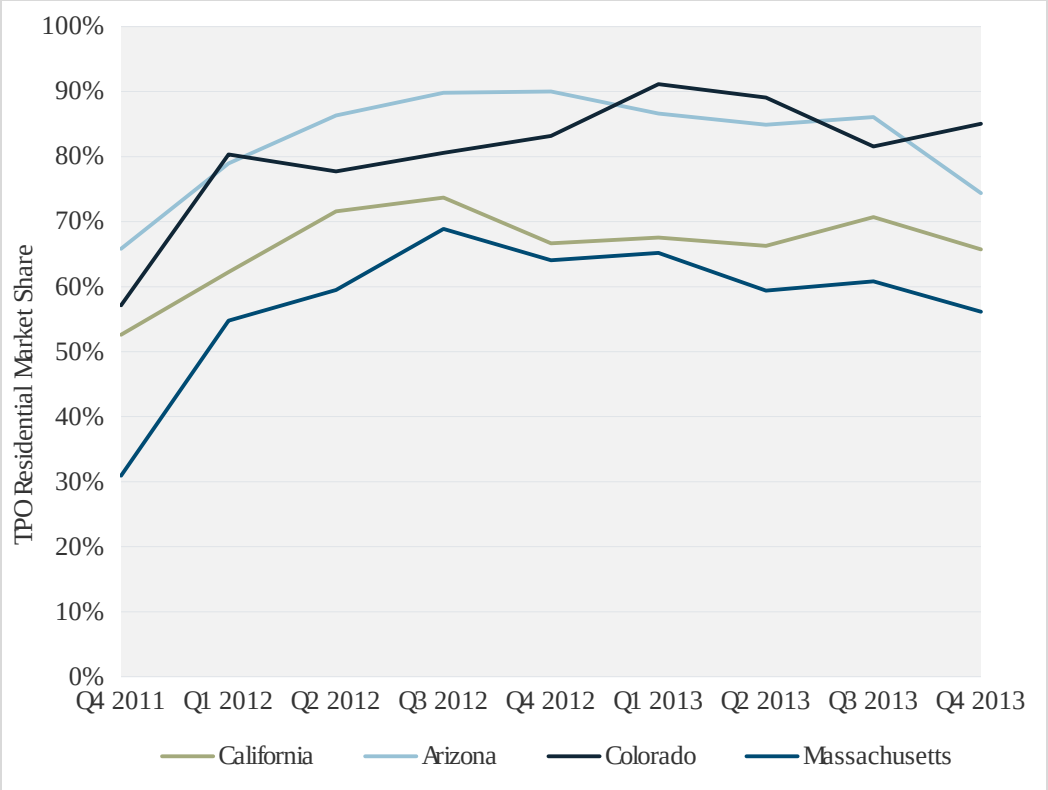
Residential Third-Party Ownership

Figure 2.9 Percentage of New Residential Installations Owned by a Third Party in CA, AZ, CO, and MA, Q4 2011-Q4 2013



	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
CA	52.6%	62.2%	71.6%	73.7%	66.7%	67.6%	66.3%	70.7%	65.7%
AZ	65.8%	78.9%	86.3%	89.8%	90.0%	86.6%	84.9%	86.1%	74.4%
CO	57.1%	80.3%	77.7%	80.6%	83.2%	91.2%	89.1%	81.6%	85.1%
MA	30.9%	54.8%	59.5%	68.9%	64.0%	65.2%	59.4%	60.8%	56.1%

In most mature state markets, third-party-owned (TPO) residential PV systems continue to be an attractive option for many homeowners.

Arizona, California, and Massachusetts all saw TPO market share drop in Q4 2013. However, it is important to note that California's TPO figures are only based on residential installations that received incentives offered by the California Solar Initiative (CSI). Since a majority of residential installations came on-line in California without a CSI rebate in Q3 2013 and Q4 2013, TPO market share figures from the most recent two quarters represent less than half of California's residential market, and the overall TPO market share may be higher or lower than shown here.

Nevertheless, the increased availability of residential solar loans and PACE financing has served as an increasingly popular alternative for homeowners in California. Most notably, the HERO PACE program is currently in 54 towns and cities, and is expected to enter more than 50 additional communities in 2014. In Arizona, installers report that a rebound in the housing market has led to an increased number of systems being financed through mortgages and home equity loans. In Massachusetts, regional banks are now providing loans to homeowners for the purchase and installation of solar systems. Lastly, Colorado saw a 3.5% uptick in TPO market share, despite the fact that Solar*Rewards incentives for TPO systems were set at less than half the amount offered to direct-owned systems.

A major factor that will impact the viability of the TPO business model is the role utilities will play in the DG market. It is still possible that utilities may enter the residential PV market, offering existing customers discounts on retail rates by owning and operating residential systems themselves. Some utilities have already invested in project finance funds created by TPO providers or have directly invested equity in these companies, but generally through the utilities' unregulated independent power producer (IPP) arms, which are typically prohibited by law from operating within the utility's regulated service territory. In turn, utility investment in DG provides more opportunities for market growth across the U.S. because of utilities' access to and business relationships with existing customers.

The addressable residential market is still massive compared to the number of customers who have gone solar, leaving an enormous opportunity for growth, and no single strategy to deliver systems to residential rooftops has yet proven dominant. In the near term, it is expected that TPO PV systems will continue to drive the residential market. Looking toward 2014, however, it can be expected that there will be many new entrants seeking to find a place on the residential value chain as financiers, service providers, or both.

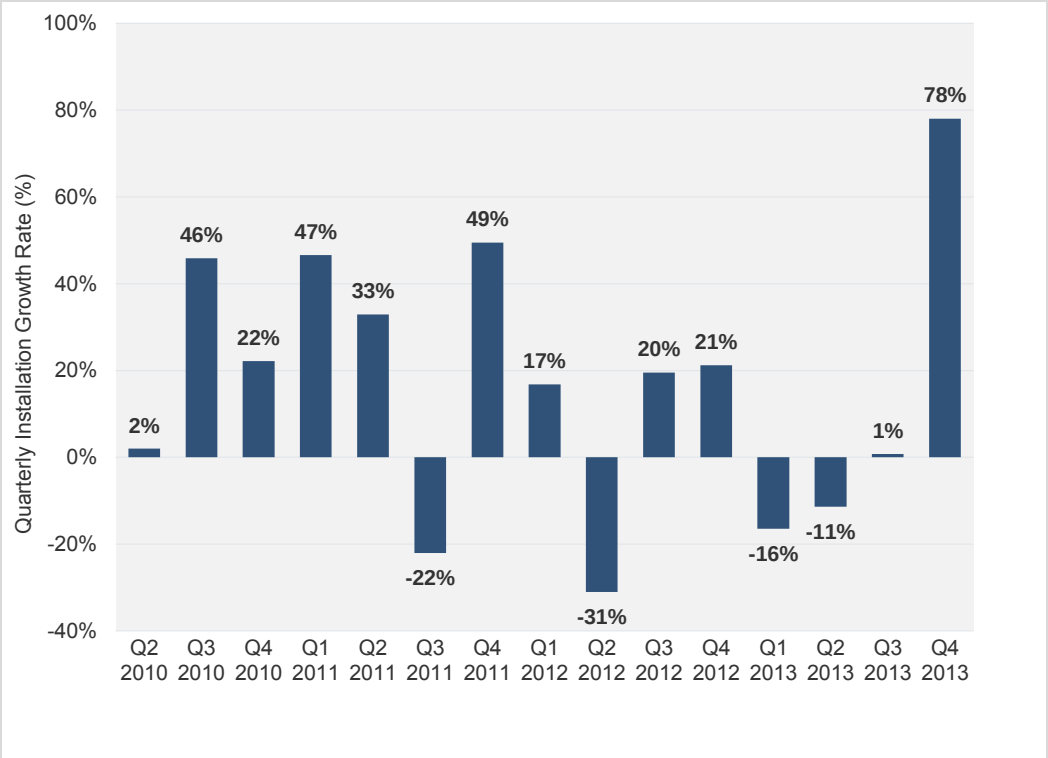
Non-Residential

Key Figures

- 1,112 MW installed in 2013, representing 4% growth over 2012
- 405 MW installed in Q4 2013, representing 78% quarterly growth

Thanks to a huge Q4, the non-residential market (comprising commercial, government, school and nonprofit installations) squeaked out 4% annual growth at the national level. Still, it was a difficult year overall for the market. Three of the top five state markets in 2012 (Arizona, California and New Jersey) shrank in 2013. While this decline was balanced by impressive growth in a number of other markets, most notably Massachusetts, it made for a volatile period for project developers.

Figure 2.10 Quarterly Non-Residential Installation Growth, 2010-2013



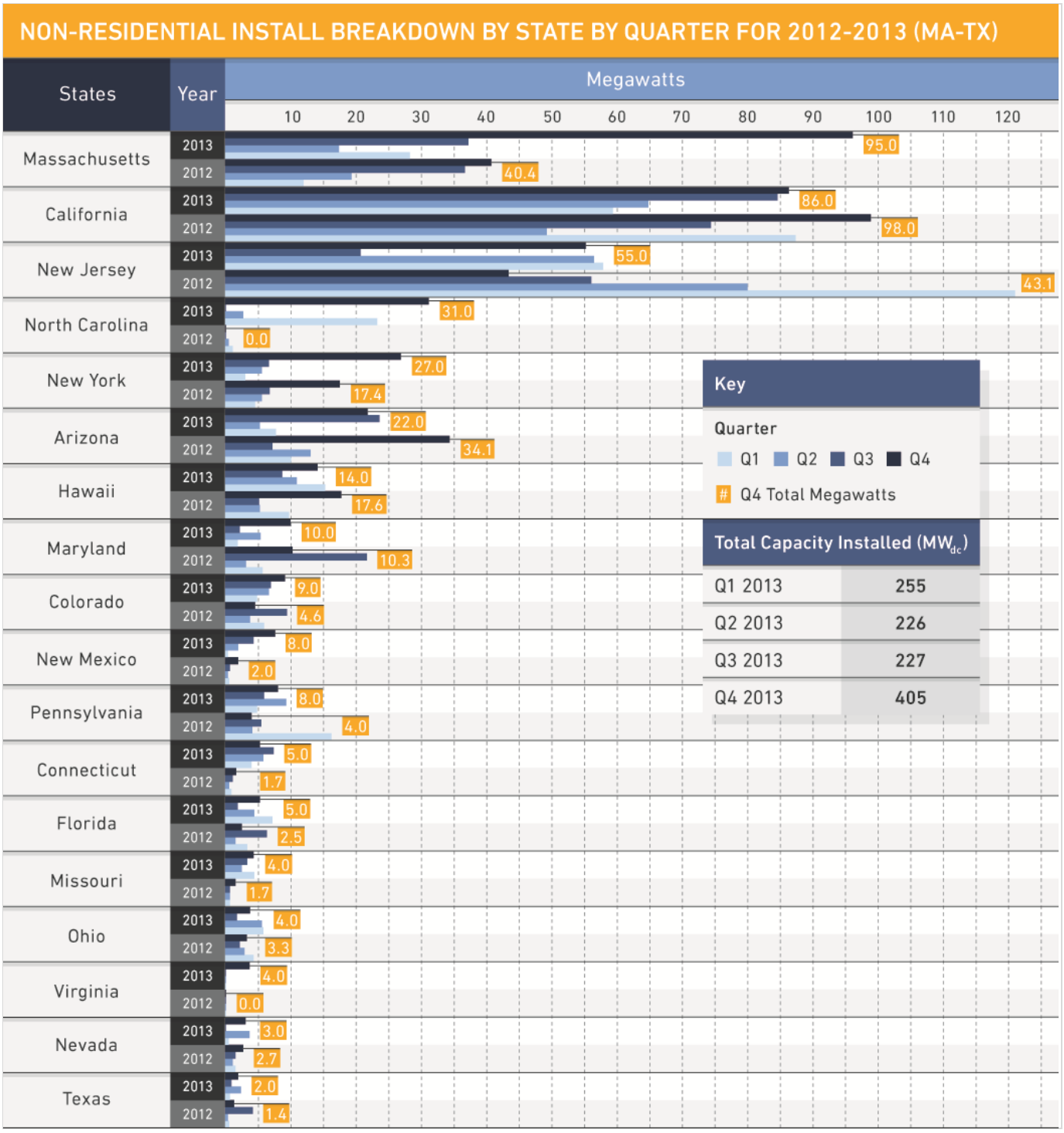
Within the Q4 2013 data, there are a number of positive signs for this market's recovery in 2014.

- **New Jersey Market Recovery** – New Jersey saw early signs of a recovery from its SREC-oversupply-driven slump in Q4, installing 55 MW, up from a low of 21 MW in Q3. As is discussed in more detail in the New Jersey section of the report, SREC pricing and supply/demand indicators suggest that the New Jersey market will see a stronger 2014 overall, though it is unlikely to reach its previous heights.
- **Massachusetts Solar Shines** – The Massachusetts market now has visibility regarding the next phase of its SREC program, dubbed SREC II, and 2014 will see a mixture of installations from final SREC I projects (of which there are many) and projects under the new scheme, combining to create another strong year for 2013's third-largest non-residential market.
- **Secondary Market Expansion** – A number of states with previously small or stagnant non-residential markets will see meaningful installation growth in 2014. In particular, look for significant figures out of New York (75 MW), Arizona (70 MW), and Colorado (41 MW).

We anticipate a resumption of growth in the national non-residential sector in 2014, with installations growing 40% overall to reach 1,554 MW.

For NSD Survey Respondents Only

Figure 2.11 Non-Residential PV Installation Breakdown by State, 2012-2013



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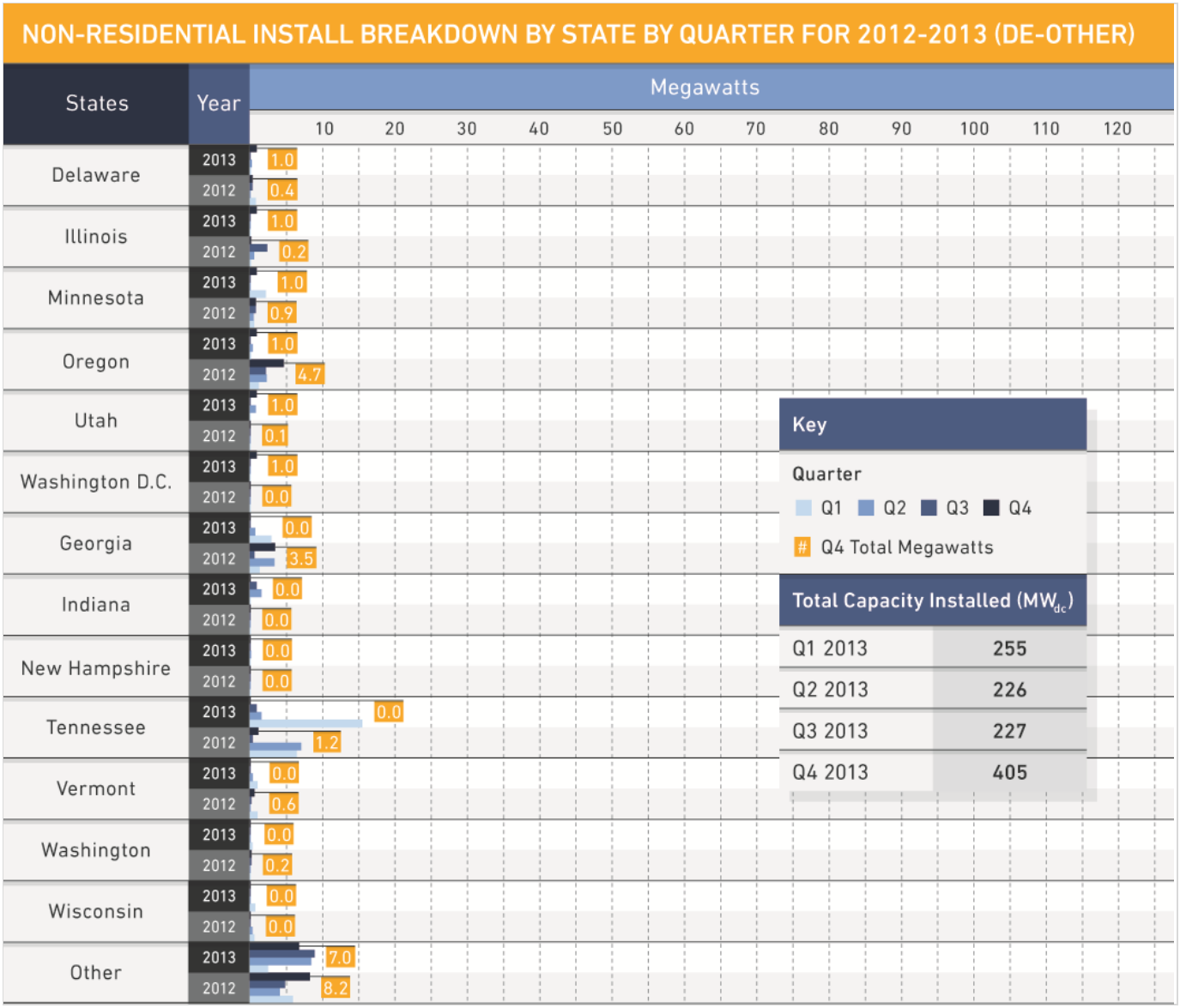


Utility

Key Figures

- 2,847 MW installed in 2013, representing 58% growth over 2012
- 1,442 MW installed in Q4 2013, up 67% over the market segment's previously high in Q4 2012

To place the utility PV sector's impressive installation growth in historical perspective, utility PV installations in 2013 alone account for approximately one-quarter of all cumulative PV capacity in the U.S. as of the end of 2013. Of this total, a record-breaking 1.4 GW came on-line in Q4

2013 alone. In fact, nine of the ten largest PV projects currently in operation were completed or partially commissioned in 2013.

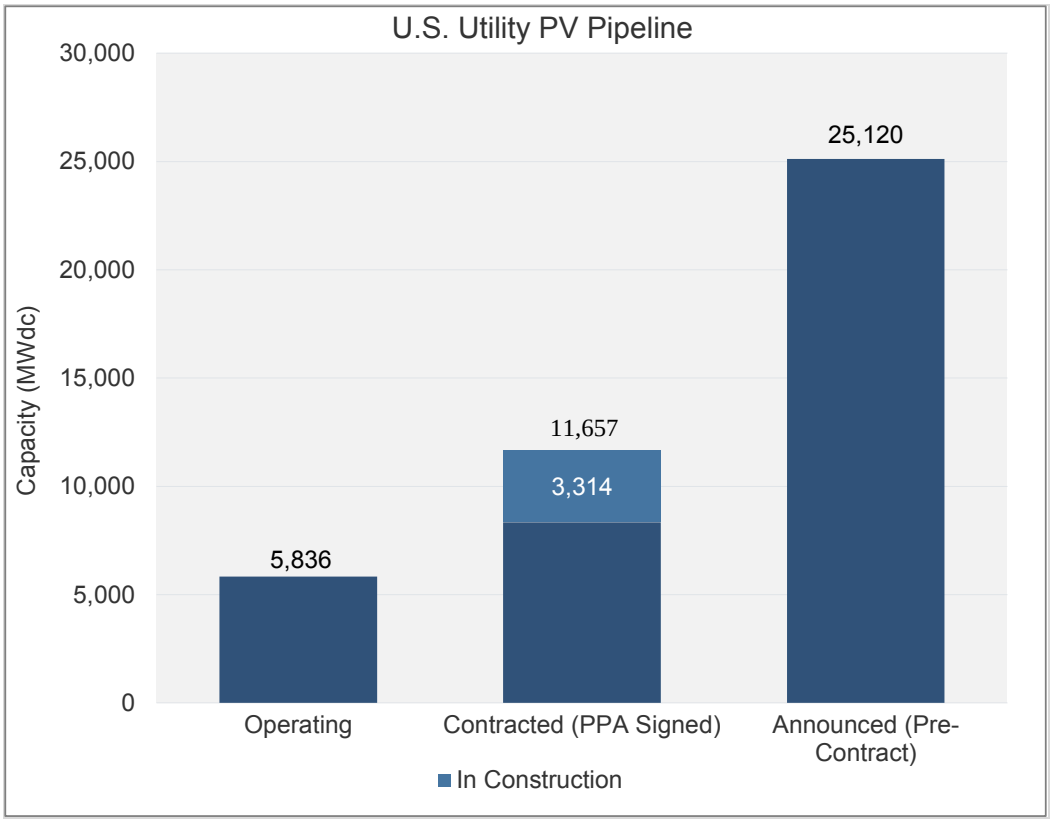
Figure 2.12 Ten Largest PV Projects Currently in Operation

Project Name	Developer	Capacity (MWdc)	State	Offtaker	Owner(s)	Online
Topaz Solar Farm: Phase I-III	First Solar	344.7	CA	Pacific Gas & Electric	MidAmerican Energy Holdings	2013
Desert Sunlight: Phase I	First Solar	320	CA	Southern California Edison, Pacific Gas & Electric	NextEra Energy Resources, GE Energy Financial Services, Sumitomo Corp.	2013
Agua Caliente Solar: Phase I-V	First Solar	319.6	AZ	Pacific Gas & Electric	NRG Energy, MidAmerican Energy Holdings	2012/ 2013
California Valley Solar Ranch: Phase I-V	SunPower	287.4	CA	Pacific Gas & Electric	NRG Energy	2012/ 2013
Mesquite Solar I: Phase 1-3	Sempra Generation	167.3	AZ	Pacific Gas & Electric	Sempra Generation, ConEdison	2011/ 2012
Campo Verde Solar	First Solar	159.8	CA	San Diego Gas & Electric	Southern Company, Turner Renewable Energy	2013
Imperial Solar Energy Center South: Phase I-III	Tenaska Solar Ventures	149.5	CA	San Diego Gas & Electric	Csolar Development, LLC, Prudential	2013
Arlington Valley Solar Energy II: Phase I-II	LS Power	145.9	AZ	San Diego Gas & Electric	LS Power, GE Energy Financial Services	2013
Catalina Solar: Phase I-II	EDF Renewable Energy	143	CA	San Diego Gas & Electric	GE Energy Financial Services, MetLife, Union Bank N.A., Citi Bank	2013
Antelope Valley Solar Ranch One: Phase I and II	First Solar	114.9	CA	Pacific Gas & Electric	Exelon Corporation	2012/ 2013

Source: GTM Research U.S. Utility PV Tracker

But despite this impressive growth in installations, project pipeline replenishment was in the red for the first time in the segment's history in Q4, with installations outpacing new procurement as RPS-driven demand begins to wane and with less than three years now remaining for the 30% federal Investment Tax Credit. The contracted pipeline of projects fell from 12.6 GW to 11.7 GW, 3.3 GW of which are currently in construction with expected completion in the next two to three years.

Figure 2.13 Utility PV Pipeline



Source: GTM Research U.S. Utility PV Tracker

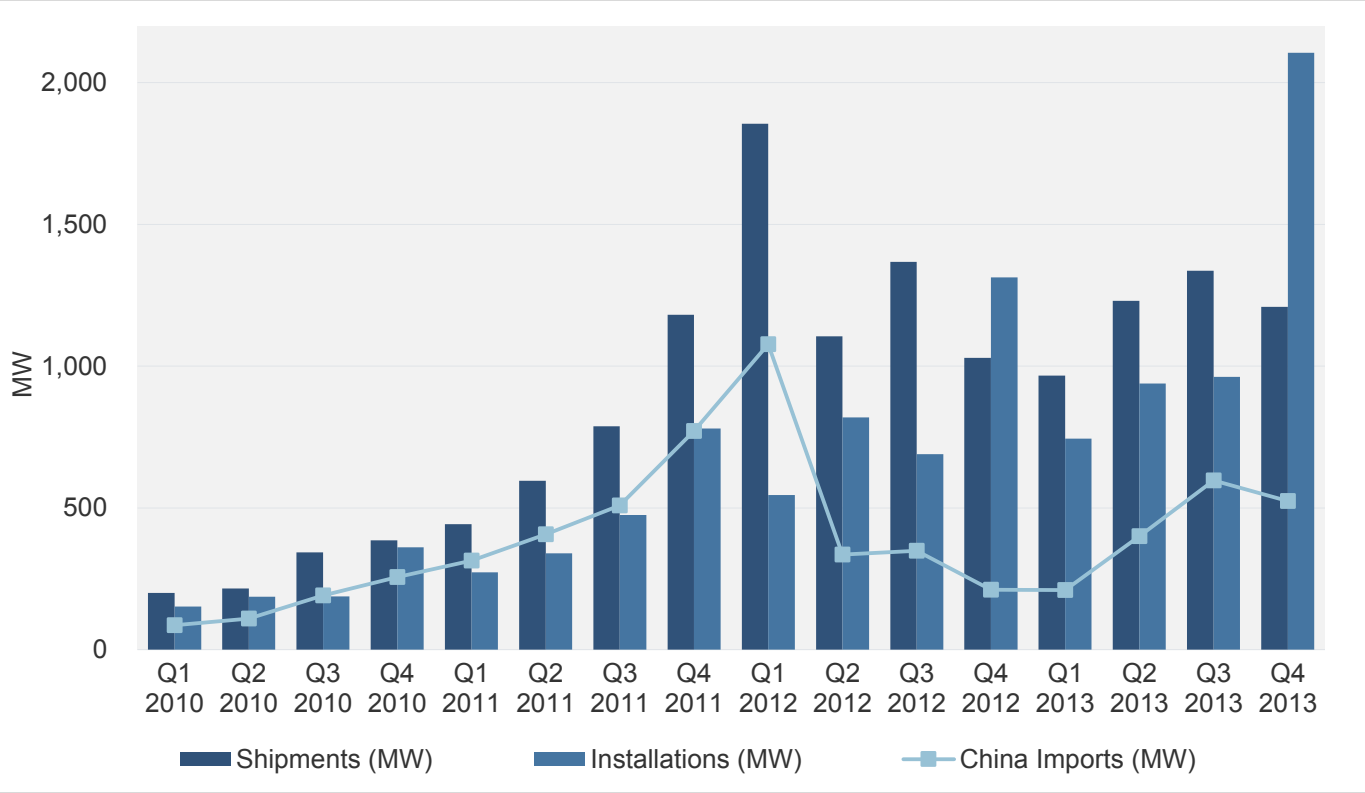
Looking forward to 2014, the demand landscape has shifted toward projects in the 1 MW to 20 MW range in order to meet utilities' near-term capacity needs and remaining RPS compliance obligations. New procurement of utility PV in the 50 MW to 100 MW range is currently confined primarily to Georgia Power's Advanced Solar Initiative and the wave of new RFPs that will be issued by North Carolina's IOUs to meet the ample capacity remaining for their RPS requirements. A glimpse of future utility PV demand based on pure cost-competitiveness has come from Xcel Energy in Colorado, which has received approval to procure 170 MW of utility PV as a hedge against volatile natural gas prices.

2.1.3. Module Shipment Analysis

Estimated module shipments into the U.S. market (including both imports and domestic shipments) fell from 1.3 GW in Q3 2013 to 1.2 GW in Q4 2013. Similarly, imports from China fell from an estimated 597 MW in Q3 to 525 MW in Q4.

On an annual basis, module shipments into the U.S. fell from 5.4 GW in 2012 to 4.7 GW in 2013, a positive sign that indicates that more balanced inventory levels exist today than one year ago. Note that shipment levels are expected to exceed installations in most years, in light of the fact that the U.S. is a growing market and some portion of shipments are, at any given time, sitting in warehouses or in construction.

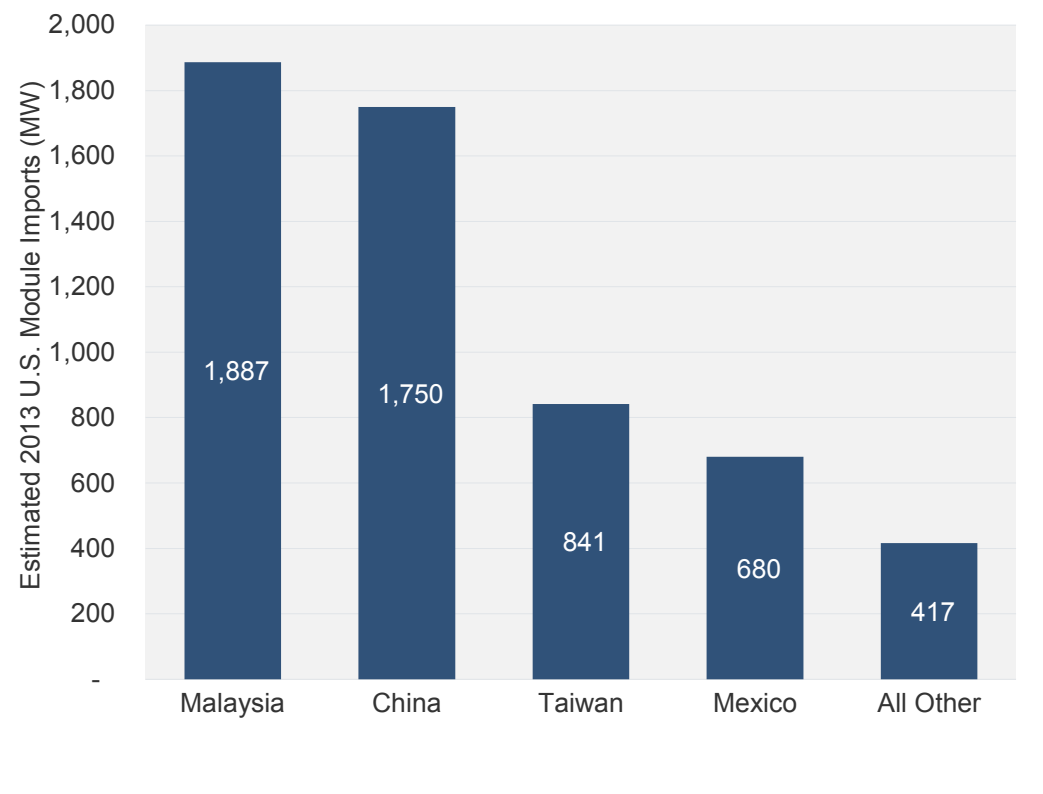
Figure 2.14 U.S. PV Module Imports and Installations, 2010-2013



Source: U.S. International Trade Commission, GTM Research

Perhaps surprising to many market participants is the fact that more modules were imported into the U.S. in 2013 from Malaysia (1.9 GW) than from China (1.8 GW). A number of manufacturers, including First Solar and SunEdison, have manufacturing operations or OEM agreements in Malaysia, which has led to the country's position as the top PV module exporter.

Figure 2.15 U.S. Module Import Sources, 2013



Source: U.S. International Trade Commission, GTM Research

2.1.4. China Import Tariff Petition

On December 31, 2013, SolarWorld Industries filed a new antidumping/countervailing duty petition before the U.S. International Trade Commission (ITC). This petition seeks to prevent Chinese module manufacturers from producing solar wafers in China, shipping them to Taiwan for cell manufacturing, and then sending them back to China for module assembly, and in doing so, avoiding the U.S. import tariffs of more than 30% that were imposed after SolarWorld's initial petition from 2011.

SEIA has expressed its opposition to this petition, but regardless of one's views about it, the case is likely to significantly impact the U.S. solar market, in large part because of its scope. In contrast to the initial tariffs, which apply only to crystalline silicon PV cells manufactured in China, this petition broadens the scope both geographically (adding Taiwan) and vertically (adding both wafers and modules).

At a minimum, SolarWorld seeks import duties on Taiwanese cells, which would eliminate the Taiwan tolling strategy currently employed by most Chinese suppliers. In addition, in order to prevent Chinese manufacturers from simply shifting their cell tolling to another country, the

petition also seeks tariffs on modules that use Chinese ingots or wafers, regardless of where the cell manufacturing takes place.

Figure 2.16 Trade Petition Scope Table

Manufacturing Location				
Wafer	Cell	Module	Subject to Initial Tariff?	Subject to New Petition?
China	China	China	Yes	
China	China	Taiwan	Yes	
China	Taiwan	China	No	Yes
China	Taiwan	Taiwan	No	Yes
China	Taiwan	Other	No	Yes
China	Other	China	No	Yes
China	Other	Other	No	No
Other	Taiwan	Taiwan	No	Yes
Other	Taiwan	China	No	Yes
Other	China	China	Yes	
Other	Other	China	No	No

The Department of Commerce, which ultimately determines dumping and subsidy margins, has broad authority to dictate the scope of the investigation, so its decision on this issue will make a major difference. If tariffs are ultimately imposed on any module using Chinese ingots or wafers, there will be little ability to use a value-chain strategy to avoid the ultimate tariffs. China dominates the ingot and wafer manufacturing landscape with 73% of current global wafer capacity, and there are far fewer non-Chinese wafer suppliers than there are for cells or modules.

But even a much narrower interpretation that only examines Taiwanese cells and Chinese modules still results in a scenario that could have a ripple effect in the U.S. market if significant tariffs are imposed. Some Chinese manufacturers have the capability to outsource both cell and module manufacturing beyond China and Taiwan, but they are the exception rather than the rule. And absent new tariffs, China would likely ship nearly 3 GW of modules into the U.S. this year – more than could easily be routed elsewhere.

There are more important nuances to the process through which the ITC and Department of Commerce determine import tariffs. For example, Taiwan is considered a “market economy” for the purposes of these investigations, whereas China is not. The primary result of this classification is that import tariffs on Chinese products are both more easily imposed and generally larger than those on Taiwanese products.

The impact of either increasing prices on Chinese modules or shutting Chinese producers out of the market would be most severe in the distributed solar market. According to the GTM Research U.S. PV Leaderboard, Chinese manufacturers had a 71% market share of installed modules in the residential and commercial markets in the first three quarters of 2013.

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This could all be rendered moot if the U.S. and China were to reach a negotiated settlement. This was the result in Europe and might well be the result here as well. But in the meantime, we would caution not to make the mistake of taking this petition lightly – it is likely to reshape the U.S. solar market in one way or another.

Figure 2.17 Trade Petition Timeline

EVENT	AD INVESTIGATIONS	CVD INVESTIGATIONS
Petitions Filed	December 31, 2013	December 31, 2013
DOC Initiation Date	January 22, 2014	January 22, 2014
USITC Preliminary Determinations*	February 14, 2014	February 14, 2014
DOC Preliminary Determinations**	June 11, 2014	March 28, 2014
DOC Final Determinations	August 25, 2014†	June 11, 2014
USITC Final Determinations***	October 9, 2014	July 28, 2014†
Issuance of Orders****	October 16, 2014	August 4, 2014†

Source: U.S. Department of Comment, International Trade Administration

NOTE: Commerce preliminary and final determination deadlines are governed by statute. For CVD investigations, the deadlines are set forth in sections 703(b) and 705(a)(1) of the Tariff Act of 1930, as amended (the Act). For AD investigations, the deadlines are set forth in sections 733(b) and 735(a) of the Act. **These deadlines may be extended under certain circumstances**.

†Where the deadline falls on a weekend/holiday, the appropriate date is the next business day.

*** If the ITC makes negative preliminary determinations of injury, the investigations are terminated.**

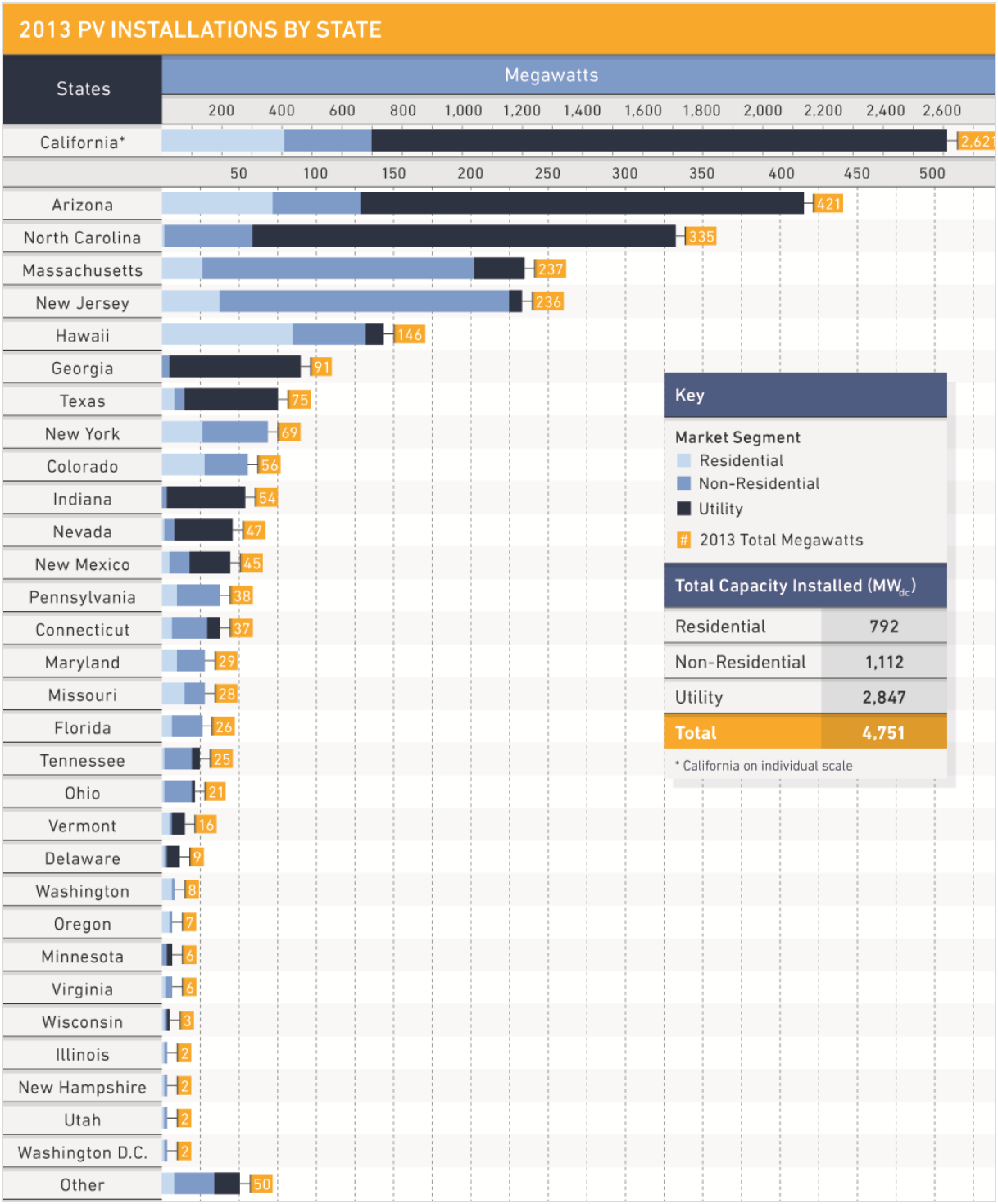
****The effective date of Commerce's preliminary determinations may be applied retroactively by 90 days in the event (1) the Petitioner alleges critical circumstances, and (2) both the USTIC and DOC render affirmative critical circumstances determinations. Petitioner, however, has not yet alleged critical circumstances.**

*****This will take place only in the event of final affirmative determinations from Commerce.**

******This will take place only in the event of final affirmative determinations from Commerce and the ITC.**

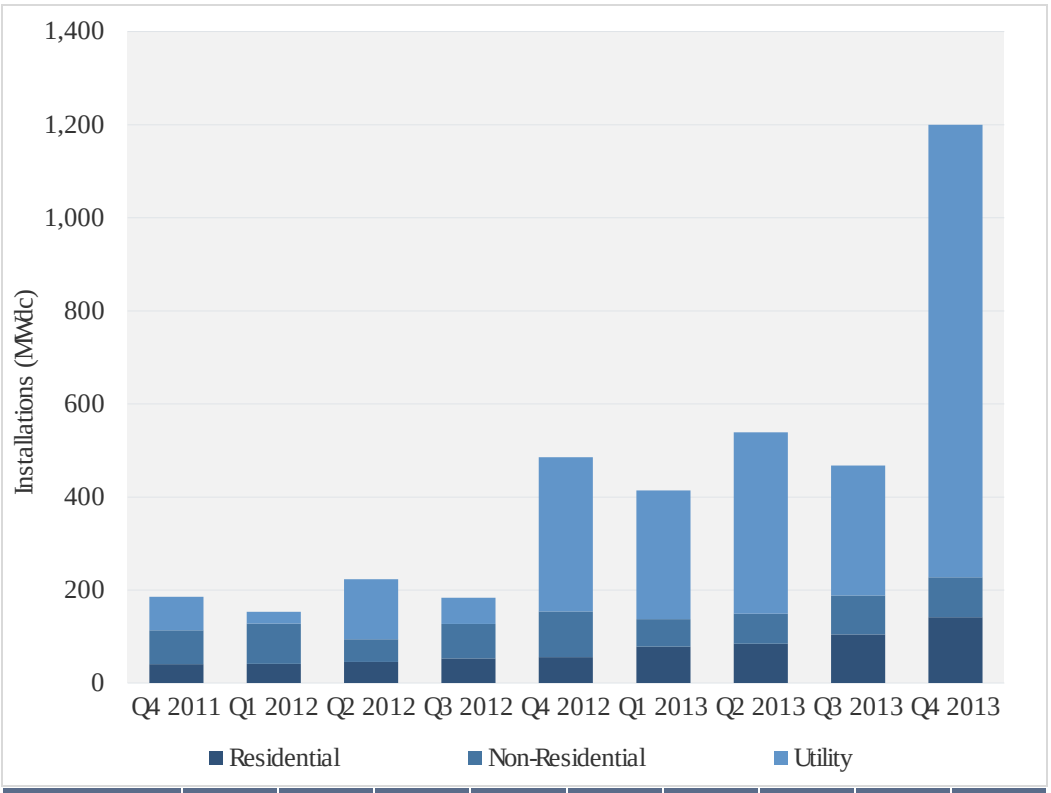
2.1.5. State Market Analysis

Figure 2.18 2013 PV Installations by State



California: The Gigawatt Golden State

Figure 2.19 California PV Installations by Market Segment, Q4 2011-Q4 2013



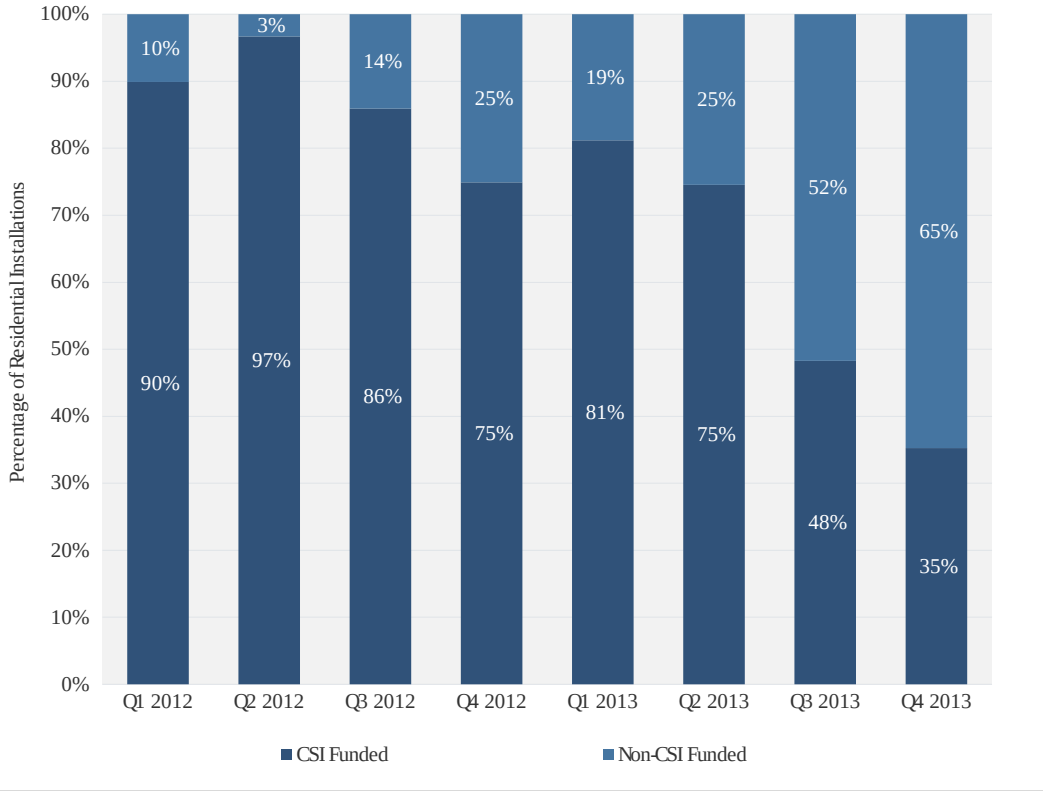
	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Residential	41	42	46	53	56	79	85	105	142
Non-Residential	73	87	49	74	98	59	64	84	86
Utility	72	25	129	57	331	277	390	279	973
Total	186	153	224	184	485	414	539	467	1,200

2013 ranks as a landmark year for California's PV market, which added 2.6 GW and accounted for more than 50% of the entire U.S. market at year's end. The residential and non-residential markets both eclipsed the 1 GW mark for cumulative capacity installed, despite the impending depletion of state-level incentives offered by the California Solar Initiative (CSI). Meanwhile, the utility PV market saw a significant drop-off in new procurement, but added nearly 2 GW in 2013 due to the expedited construction schedules of several large-scale projects.

California's **residential** market jumped 109% year-over-year, from 196 MW to 410 MW, highlighted by a string of record-breaking quarters that topped out at 142 MW in Q4 2013. Amidst this growth, residential incentives offered by the CSI are now fully depleted in PG&E territory, while SCE and SDG&E are both at the tail-end of their final incentive steps. In turn, the residential market's

impressive growth in 2013 paralleled a growing number of projects that came on-line based purely on net energy metering (NEM), the federal 30% investment tax credit, and, in the case of third-party-owned systems, accelerated depreciation.

Figure 2.20 CSI-Funded vs. Non CSI-Funded Residential Installations, Q4 2011-Q4 2013



As Figure 2.20 shows, Q3 2013 and Q4 2013 were the first quarters in which the majority of residential installations in IOU territories came on-line without a CSI rebate. Installers have translated this retail rate parity into installation growth by ramping up sales capacities to navigate saturated local markets and enter untapped communities. Both in IOU territory and across the rest of the state, installers have expanded their geographic footprints by opening up smaller, more localized sales offices and establishing new partnerships with homebuilders as the housing market continues to recover. Outside of the IOU territories, SMUD and LADWP remained purely incentive-driven markets that together have consistently accounted for 5 MW to 10 MW each quarter.

The residential market's ability to build on its strong performance this year will depend on installers continuing to achieve scale without the financial cushion of upfront CSI rebates. Installer market share figures, collected in GTM Research's U.S. PV Leaderboard, indicate that the top-ten installers in 2013 accounted for more than 50% of new residential installed capacity for the first time in the state's history. While industry consolidation is by no means a prerequisite for continued growth, leading installers have noted the particularly strong value-add of opening up numerous localized sales offices and leveraging retail partnerships, which create closer and

more trusted links to customers in communities bombarded by numerous installers. Equally important, continued access to financing solutions either in the form of third party leases, PPAs, or new cash offerings will continue to grow the market. Most notably, the HERO PACE financing program in California is expected to expand from 54 towns and cities in 2013 to well over 100 communities in 2014.

The California **non-residential** market added 293 MW in 2013, down 5% year-over-year, but still ranked as the largest non-residential state market for the second straight year. Although CSI rebates are depleted in PG&E territory, performance-based incentives remain at attractive levels of $0.032/kWh (commercial) and $0.114/kWh (government/nonprofit) in both SCE and SDG&E territories. The majority of installation growth in 2013 came from school and government offtakers, which are unable to utilize the federal ITC directly, as tax-exempt entities continue to seek PPAs as a hedge against rising retail electricity rates. In 2014, three major drivers are expected to spur renewed growth for commercial and industrial installations:

- Further standardization and introduction of new financing solutions such as PACE
- CSI incentives are expected to remain available in SCE and SDG&E territory until the second half of 2014
- The CPUC's recent approval of new rate and time-of-use charges for C&I customers will increase the value proposition of solar as a hedge against higher monthly electricity bills

Lastly, California's **utility-scale PV** market in 2013 more than tripled its 2012 total, with 1,918 MW coming on-line. This growth is primarily attributed to the full or partial commissioning of several large-scale projects with longstanding PPAs in place. The partial commissioning of these large-scale projects also masked the delayed completion of projects that are part of the Renewable Auction Mechanism and small-scale feed-in tariff programs, which have encountered onerous permitting and siting delays. Most notably, 70 MW of SCE CREST projects are now poised to come on-line in 2014 due to San Bernardino County's decision to lift its moratorium on solar projects seeking land-use permits. 2014 is expected to see a slight drop-off in utility PV installations due to the lack of new procurement by the IOUs over the last year.

Beyond 2014, major regulatory reform will target the residential market via the implementation of state Assembly Bill (AB) 327, which directs the California Public Utilities Commission to institute major overhauls to rate design and NEM. Key pieces of the legislation, relevant proposals, and updates are shown in the following chart.

Figure 2.21 AB 327 Update: New Proposals Shed Light on Future Net Metering and Rate Design Scenarios

Legislation Item	AB 327 Language	Relevant Updates or Proposals
Fixed Charges	Up to $10/month	CPUC Staff: Phase in approach of $5/month to $10/month by 2018 (annual increases post-2015 to align with inflation)
Rate Design	Tiered electricity rates could be flattened from four to as few as two	CPUC Staff: Gradual reduction to two tiers between 2014 and 2018 with rate differential narrowing to 20% between tier 1 and tier 2 in 2018
Expiration Current NEM Program	The earlier date of July 1, 2017 or when each utility hits a predefined capacity cap	Aggregate Cap Limits: 5% of Non-Coincident Demand SDG&E: 1.87% (Dec 2013) PG&E: 2.04% (Dec 2013) SCE: 1.5% (Jan 2014)
Grandfathering Customers Under the Current NEM	After the current NEM program expires, preexisting NEM customers will be grandfathered in under the current scheme for a "length of time determined by the commission." This length of time will depend on a "reasonable expected payback period" of the PV system based on the first year it came on-line.	Proposed Grandfather Periods PG&E and SDG&E: Through 2023 if installed before April 2014; through 2020 if installed between April 2014 and 2015 SCE: Through 2023 if installed before July 2017 CalSEIA: 30 years if installed before July 2017 CPUC's Timeline: March 2014 decision
New Uncapped NEM Program Current NEM's Expiration	Setting in place a process through which the CPUC will introduce a new, uncapped NEM program to take effect when the current one expires	CPUC: Must develop a new NEM structure by the end of 2015

Source: GTM Research

An important question for both customers and installers to consider is this: Will the current NEM program's predefined capacity caps be hit before July 1, 2017? The answer is likely yes, but the first utility cap will not be reached until Q1 2016. Currently, installers report that AB 327 is not a major part of customers' decision-making processes when they are deciding whether to go solar. But in 2015, not only will the CPUC have finalized the next NEM program, but every IOU will have hit approximately 75% of its aggregate capacity limit, as the following figure illustrates.

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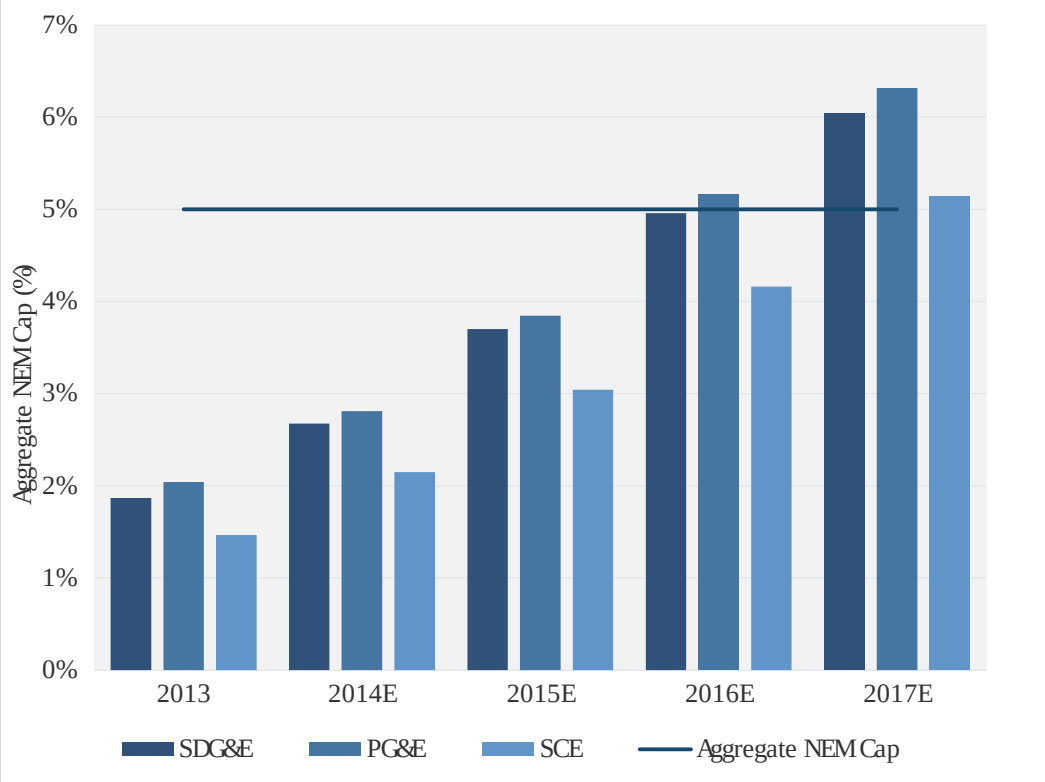
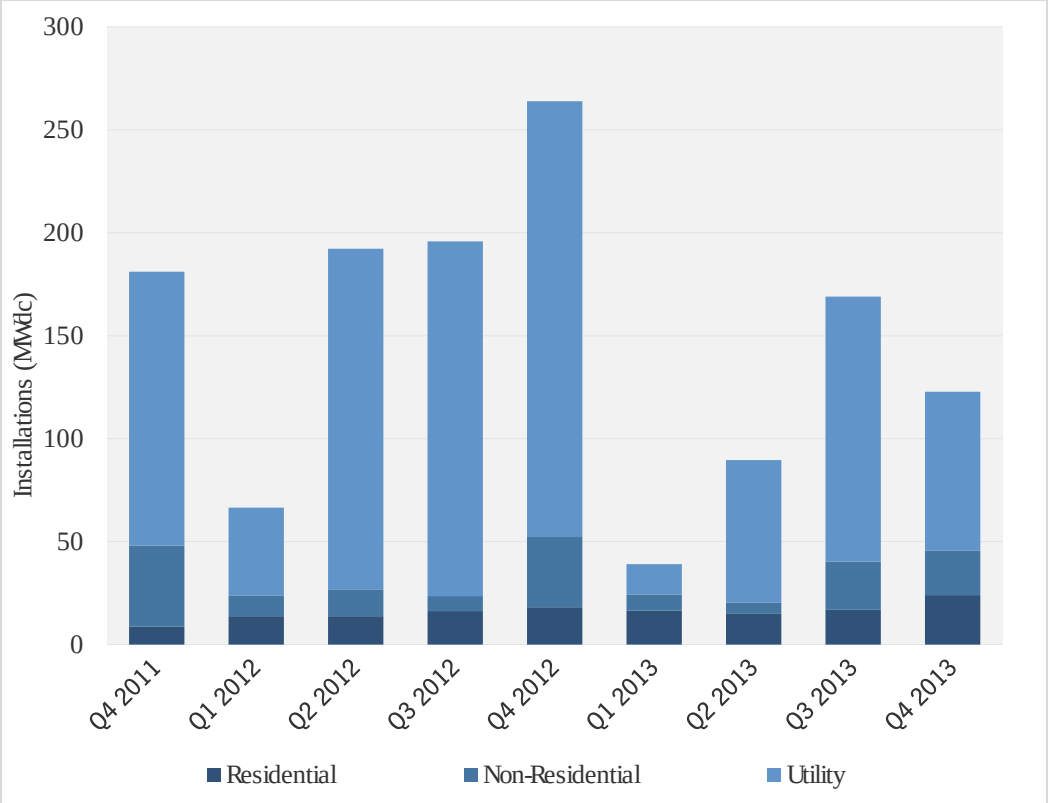
Figure 2.22 Progress Towards 5% Aggregate NEM Cap by IOU, 2013-2017E



Arizona: NEM Reform and Waning Incentives Spur Short-Term Growth

Figure 2.23 Arizona PV Installations by Market Segment, Q4 2011-Q4 2013



	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Residential	8.6	13.8	13.8	16.3	18.2	16.6	15.2	16.9	24.0
Non-Residential	39.4	10.1	13.0	7.2	34.1	7.7	5.3	23.5	21.7
Utility	133.1	42.6	165.5	172.4	211.6	14.8	69.2	128.7	77.2
Total	181.1	66.5	192.3	195.9	263.9	39.1	89.7	169.1	122.9

The Arizona solar market in 2013 was at the forefront of politicized debates surrounding the future of net metering and the availability of state incentives. During 1H 2013, the DG market experienced consecutive down quarters, as installers adjusted to an abrupt reduction to residential rebates and elimination of commercial PBIs in Arizona Public Service (APS) and Tucson Electric Power (TEP) territories. Meanwhile, the second half of 2013 saw a significant rebound across both market segments, rooted in a backlog of PBI-funded commercial projects secured in 2012 and a rush to land as many residential customers as possible before the new NEM scheme took effect.

The **residential** market saw 72.7 MW installed in 2013, up 17% year-over-year despite a reduction in rebate funding to $0.10/W and a hotly contested regulatory battle over adjustments to NEM. In July

2013, APS proposed to tack on a $50 to $100 monthly charge for residential NEM customers and to grandfather in new residential PV customers under the 2013 NEM scheme if they submitted an interconnection application by October 15, 2013. Instead, the ACC ruled that the deadline to be grandfathered under the old NEM scheme would be December 31, 2013. Starting in 2014, new solar customers must now pay a fixed fee of $0.70/kW/month, which amounts to a $4.90 average monthly fee that falls well below APS' original proposal. The fee will remain in effect until the results of the next rate case proceeding take effect; that rate case will be filed in 2015.

Amidst this ongoing uncertainty about when and how NEM would be reformed, installers first rushed to secure deals before the tentative mid-October deadline to grandfather in new customers, and once more before December 31, 2013. With NEM reform advertised and debated across television and radio airwaves by both solar industry advocates and APS, homeowners considering solar were well aware of the need to act quickly in order to fall under the old NEM scheme. As a result, Q4 2013 was the largest quarter ever for Arizona's residential market, with 24 MW installed.

Due to the ACC's final ruling, installers proceeded to submit 39 MW of residential interconnection applications during Q4 2013 alone, whereas Q1 to Q3 2013 saw 33 MW of residential interconnection applications combined. Equally important, approximately 50% of all residential capacity installed in Arizona during Q4 2013 came from APS projects with interconnection applications submitted between the middle of July through December 2013. Looking forward, two key market signals reveal that the residential sector is poised to sustain growth at Q4 2013 levels through the first half of 2014:

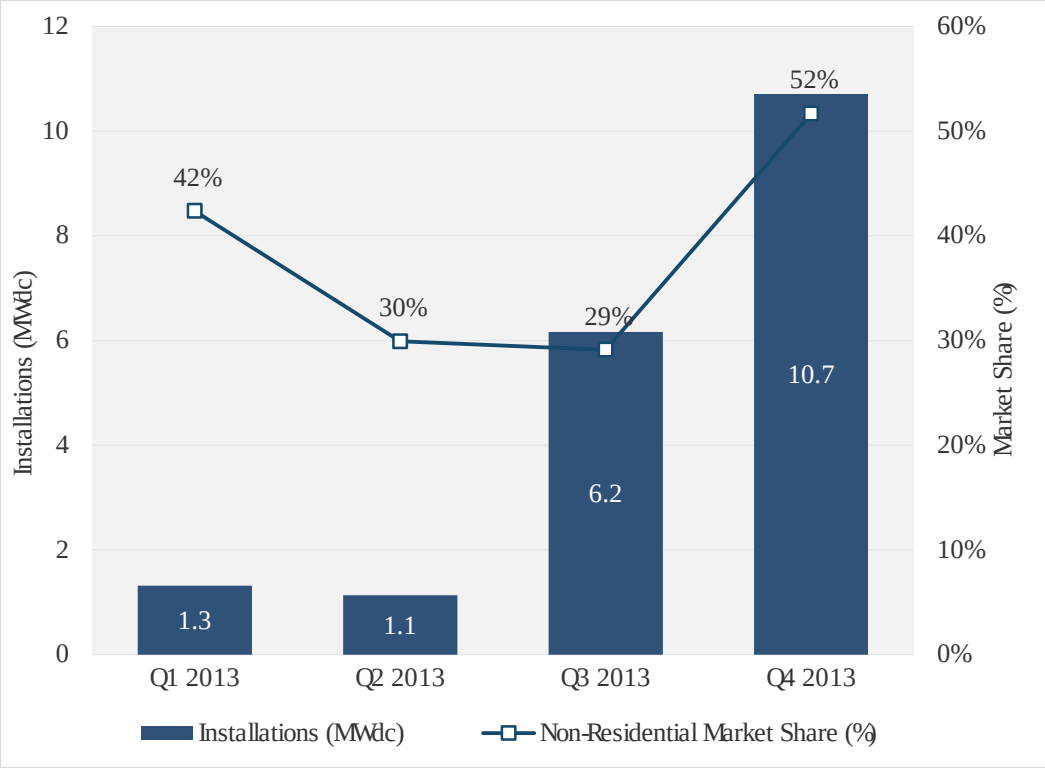
- **Large Pipeline of Grandfathered NEM Customers:** More than 30 MW of residential interconnection applications that were submitted during Q4 2013 are now reserved and slated for completion in 2014
- **Beginning Signs of Retail Rate Parity:** 15% of residential installations came on-line in Q4 2013 without an upfront rebate, due to incentive funding having depleted in late September 2013. Installers note that they have prepared for the impending end of state incentives throughout the year, and have avoided tighter margins primarily by streamlining and cutting down on soft costs related to sales operations, as has been the case in California's market without CSI rebates.

While interconnection applications in January 2014 fell 44% compared to the same month last year, installers point to the large backlog of customers secured in December and the inherent seasonality of Arizona's sales cycle as justifiable reasons for the lower numbers of customers secured in the beginning of the year. Heading into the second half of 2014, the residential market is expected to experience a minor slowdown as installers pitch deals without rebates and the addition of the new NEM scheme, which is expected to impact project economics and extend payback periods by less than one year.

The Arizona **non-residential market** added 58.1 MW in 2013, dropping 10% year-over-year and experiencing an especially lumpy development cycle, with more than 75% of non-residential installations coming on-line in 2H 2013. In early 2013, the ACC voted to abruptly eliminate all PBI funding for commercial projects in both APS and TEP territories, and to cut APS' incentive funding

for school and government projects from $66 million to $29.5 million. The market's contraction in Q1 and Q2 2013, however, was unrelated to the removal of PBIs and was primarily driven by 2012 PBI auction timelines for commercial projects and reduced incentive levels remaining for small commercial, school, and government projects. Although the majority of non-residential growth in 2013 came from commercial installations, 2014 is expected to be primarily driven by school and government projects. As the following figure illustrates, school and government installations saw a significant uptick in the 2H 2013, accounting for the majority of non-residential installations for the first time ever in Arizona's non-residential market in Q4 2013.

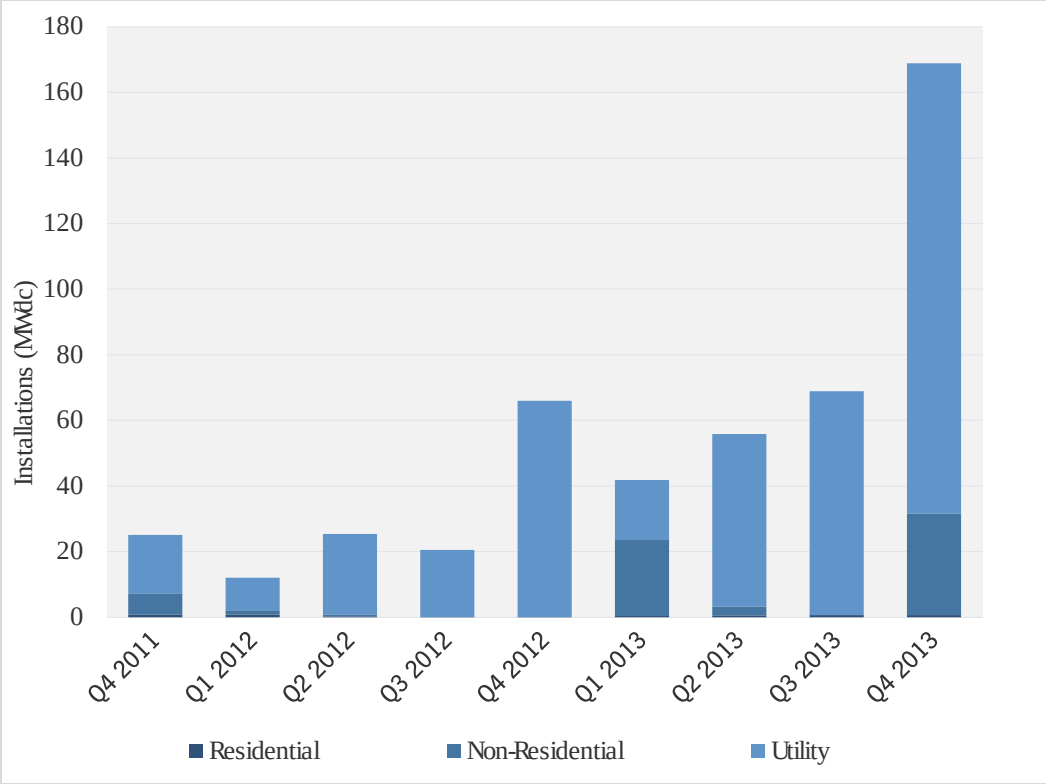
Figure 2.24 School and Government PV Installations in APS Territory, Q1 2013-Q4 2013



Looking forward to 2014, a new regulatory hurdle is on the horizon for Arizona's residential and non-residential markets. In a recent proposal submitted to the ACC, APS has proposed to **remove the 4.5% DG requirement from its Renewable Energy Standard and Tariff (REST)**, thereby lowering the REST from 15% to 10.5% for centralized solar resources only. This proposal arose because APS no longer offers incentives to new DG projects, and therefore is unable to purchase RECs from new projects coming on-line to meet future compliance obligations. In February 2014, the ACC voted to initiate a new regulatory proceeding in order to determine whether and how utilities could comply with the REST without directly purchasing RECs. A public comment period is underway and will continue until April 15, 2014.

North Carolina: Five Megawatts Is the Magic Number

Figure 2.25 North Carolina PV Installations by Market Segment, Q4 2011-Q4 2013



	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Residential	0.9	0.9	0.3	0.1	0.1	0.4	0.6	0.6	0.7
Non-Residential	6.4	1.2	0.6	0.0	0.0	23.2	2.8	0.0	31.0
Utility	17.8	10.0	24.5	20.4	65.9	18.3	52.5	68.2	137.2
Total	25.1	12.1	25.4	20.5	66.0	41.9	55.8	68.9	168.9

In 2013, North Carolina's market experienced significant growth from the healthy backlog of utility PV solar installations that secured attractive avoided cost rates from the state's major IOUs at the end of 2012. Every quarter, the utility PV market grew by at least 100% over the same period in 2012, adding 137.2 MW in Q4 2013 alone.

Collectively, **non-residential** installations added 56.9 MW in 2013, accounting for nearly 60% of the state's cumulative non-residential capacity installed. Compared to other major state markets, North Carolina has a very unique operating PV capacity profile, with an almost non-existent retail solar market that sees arbitrary spikes from corporate entities with both large loads and in-state tax liabilities. This profile is best exemplified by Apple Inc., which owns a 46 MW project at its energy-intensive data center that came on-line in Q1 and Q4 2013. Finding corporate

entities with sufficient in-state tax liability has proven the largest barrier to growth for solar in the state. One notable opportunity for additional growth lies in a recent decision by Duke Energy to offer large industrial customers an optional Green Source Rider to pay a premium for solar and other renewables. In addition to Apple's facilities, North Carolina is also home to a number of data centers owned by Microsoft, Google, and other large corporate entities. The program represents 125 MW of new demand and offers a new opportunity for these entities to develop solar on-site, as Apple did in 2013.

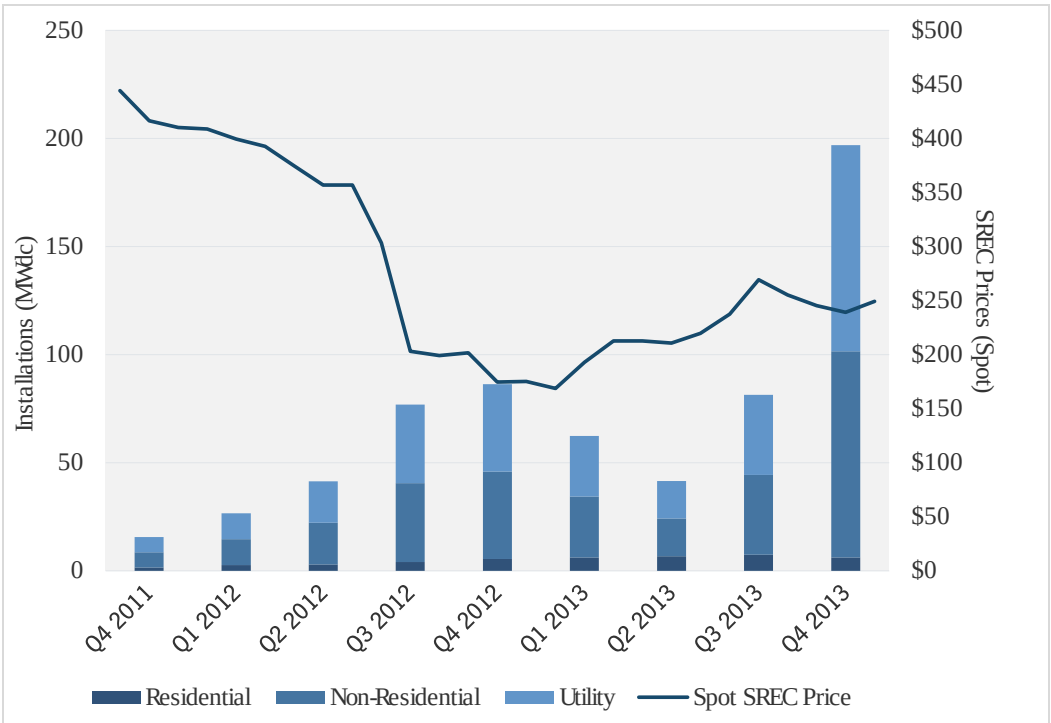
North Carolina's market growth in 2013 primarily stemmed from more than 400 MW of utility PV installations intended to deliver power to the IOUs at the end of 2012. The North Carolina Utilities Commission (NCUC) requires Duke Energy, Progress Energy, and Dominion to offer fixed-price PPAs to any projects less than or equal to 5 MWac based on the avoided cost of natural gas peaking generation. Installers rushed to register a slew of projects between 1 MWac and 5 MWac in order to take advantage of 2012 standard offer fifteen-year contracts priced between $0.075/kWh-$0.085/kWh. Opportunities for growth, however, were confined to a finite number of local installers that monopolized most of the addressable state tax equity investors. In fact, more than half of all contracted and operating utility PV capacity is currently owned by six developers, which exemplifies North Carolina's consolidated competitive landscape.

The North Carolina utility PV market is primed for even larger growth in 2014 and 2015 due to the following market drivers:

- **2013 Avoided Cost Rates Attracted Continued Investment:** In 2013, interim standard offer contracts dropped to $0.05/kWh-$0.07/kWh due to declining natural gas prices. However, throughout the year, more than 500 MW of utility PV systems under 5 MWac in size registered with the NCUC despite the lower contract price. In other words, if a developer could secure a state tax equity investor, current avoided-cost prices proved more than sufficient to generate attractive returns. The state's biennial avoided-cost hearings officially came to a close by January 2014, and the NCUC will soon rule on new and lower pricing expected to fall between $0.045/kWh-$0.05/kWh for the three IOUs.
- **New Demand for Projects Larger Than 5 MWac:** For installations above 5 MWac, developers must negotiate PPA rates on a one-off basis with the IOUs. However, negotiations can lead to contract offers below avoided cost rates and subsequently to disputes arbitrated by the NCUC that drag out development timelines. While one 23 MWdc project came on-line in Q4, new opportunities for demand will come from Duke Energy, which recently issued a 300 MWac RFP for turnkey constructed projects of more than 20 MWac. All solicited projects will have a guaranteed COD of December 31, 2015.
- **Demand Pull-In Ahead of State Credit Expiration:** As mentioned, the 35% in-state tax credit has proven to be the primary driver of growth in North Carolina, which is paid out to investors over five-year terms and capped at $2.5 million per installation. The in-state credit is scheduled to expire at the end of 2015. So while the national solar market will experience a wave of demand pull-in in 2016 ahead of the federal ITC's dropdown, North Carolina developers will be busy in 2014 and even more so in 2015 as they work to complete projects to take advantage of both the state and federal tax credits.

Massachusetts: The New (and Possibly Improved) New Jersey

Figure 2.26 Massachusetts PV Installations by Market Segment, Q4 2011-Q4 2013



	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Residential	1.5	2.6	3.0	4.1	5.5	6.2	6.8	7.5	6.2
Non-Residential	7.1	12.0	19.2	36.4	40.4	28.1	17.4	36.9	95.3
Utility	2.6	4.5	3.4	0.0	3.4	0.0	12.3	3.4	17.2
Total	11.2	19.1	25.6	40.5	49.3	34.3	36.4	47.8	118.7

Massachusetts had a record-breaking quarter, more than doubling installed capacity both year-over-year and quarter-over-quarter, with total installations of 118.7 MW in Q4 2013. After consistently growing each quarter for several years, the **residential** market dipped from 7.5 MW in Q3 to 6.2 MW in Q4. This is due to a combination of seasonality caused by this year's harsh winter and the timing of the Solarize Mass group buying program. Contracts for more than 5.1 MW of residential systems were signed in the 2012 round of Solarize Mass, and the majority of these systems were likely installed in the first three quarters of 2013. Likewise, 3.8 MW of contracts for the next phase were signed in Q4 2013, and the deadline for the subsequent phase is June 30, 2014. These two rounds are expected to help strengthen the state's residential sector throughout 2014.

As anticipated, the market was driven primarily by the booming **non-residential** market, which grew 158% quarter-over-quarter to 95.3 MW in Q4, making Massachusetts the state with the

largest non-residential sector that quarter. Projects eligible for the state's SREC I program had an interconnection deadline of December 31, 2013, causing a significant uptick in installations at the end of the year. Several factors will maintain these high installation levels through the first half of 2014:

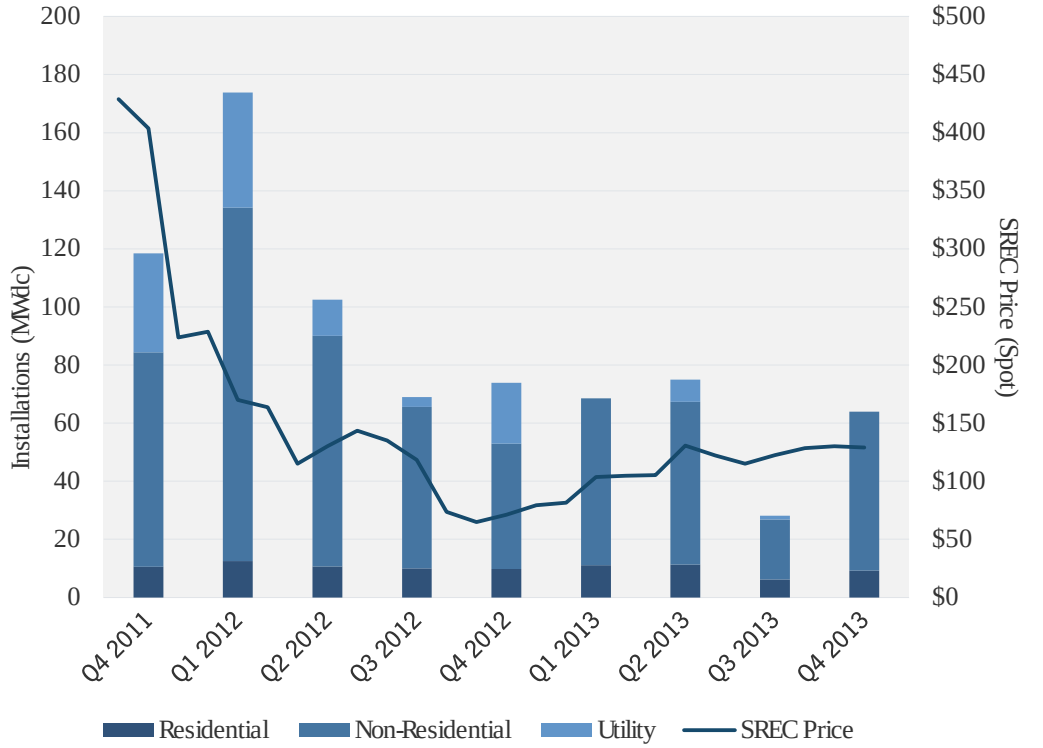
- Under the terms of SREC I, systems larger than 100 kW that expended over 50% of project costs by December 31, 2013 were granted a six-month extension to complete construction and receive an authorization to interconnect by June 30, 2014.
- Out of the 672 MW of projects qualified for SREC I, just 410 MW came on-line by the end of 2013, leaving the potential for up to 262 MW to be completed in the first half of 2014.
- Large ground-mounted projects have an incentive to come on-line during the current program rather than hold off until SREC II, which favors smaller rooftop systems. The current draft proposal places an annual limit on the capacity that may come on-line in the 'Managed Growth' sector, designed to prevent SREC oversupply. This includes all ground-mounted projects over 650 kW and ground-mounted projects between 25 kW and 650 kW that use less than 67% of annual electric output on-site. For Compliance Year 2014, this limit is expected to be just 26 MW.

Massachusetts also had its largest quarter yet for **utility PV** installations, which totaled 17.2 MW. These installations comprise publicly sited projects of more than 1 MW that were SREC I-eligible, but which secured PPAs with municipal utilities after the public net metering caps were reached across the IOUs. Projects with munis offered quicker interconnection approval processes and competitive PPAs rates of approximately $50/MWh.

Looking ahead to 2014, the non-residential sector will continue to account for the majority of new installed capacity, especially in the first two quarters of the year. Projects are already in development for SREC II, but limited annual targets will slow the rate at which they are built out. We also expect moderate, steady growth in the residential sector given the presence of most major installers and the expansion of the Solarize Mass program. Beyond 2014, SREC II is designed to ensure supply-demand balance by qualifying only a limited capacity each year until the state's target of 1,200 MW by 2020 is achieved.

New Jersey: SREC Price Stabilization Signals Renewed Growth in 2014

Figure 2.27 New Jersey PV Installations by Market Segment, Q4 2011-Q4 2013



	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Residential	10.6	12.5	10.7	10.0	9.8	11.1	11.3	6.2	9.2
Non-Residential	73.8	121.7	79.4	55.6	43.1	57.4	56.0	20.6	54.8
Utility	34.1	39.6	12.4	3.4	21.0	0.0	7.7	1.3	0.0
Total	118.5	173.8	102.5	69.0	73.9	68.5	75.0	28.1	64.0

New Jersey's solar market in 2013 continued to shrink amidst the longstanding oversupply of SRECs, hitting an unprecedented low in the third quarter. The commercial market would have fallen to even lower levels in 1H 2013, but it was artificially inflated by projects slated for completion in Q4 2012 that were ultimately interconnected in 1H 2013 due to delays brought on by Superstorm Sandy. However, the key quarter to highlight is Q4 2013, which added 9.2 MW in the **residential** market and 54.8 MW in the **non-residential** market, up 48% and 166% quarter-over-quarter, respectively.

This resumption of growth paralleled the stabilization of SREC pricing after bottoming out at $65 on the spot market in Q4 2012. Throughout the course of 2013, prices steadily crept upward to $140 by December 2013, and even reached $170 in January 2014. Installers note that their

referral bases were of limited utility due to the SREC price crash-back in 2012, but by the end of 2013, market expectations began to reset for a growing number of homeowners who were willing to accept deals based on $0.03-$0.04/kWh discounts to their monthly bills. Meanwhile, commercial developers were incentivized to freeze new development in anticipation of SREC prices ticking upward over the course of 2013. As spot prices subsequently trended up to $130 to $140 per month in Q3 2013, installers reported that SRECs reached a price threshold attractive enough to spur larger build rates starting in Q4 2013.

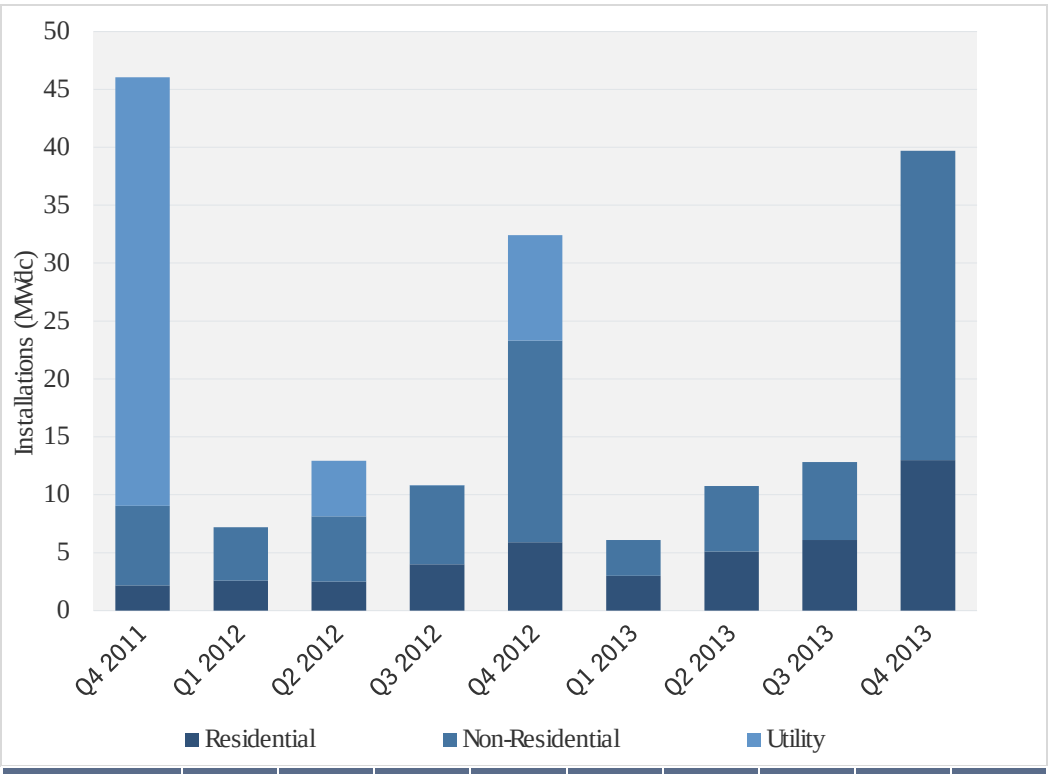
In 2014, two key factors are expected to revitalize growth in the residential and non-residential sectors, and to further stabilize SREC pricing in 2014:

- **Revised RPS Legislation Takes Effect:** New Jersey's revised solar carve-out came into effect at the beginning of Energy Year 2014 (May 2013). Under the new program timeline, compliance levels are expected to ramp up more quickly in the first few years, which, in tandem with the slow build rate between Q1 and Q3 2013, is expected to further drive up SREC prices and unlock pent-up demand. Given the low build rates in 2013 and the revised RPS that is now in place, in January 2014, SREC spot prices jumped to $170. Some developers were even able to lock in to three-, five-, or ten-year strips fixed at this price as well, which offered especially attractive financing terms to begin development.
- **PSE&G Loan Programs:** PSE&G launched its Solar Loan III program in early November, which will provide debt financing for 97.5 MW of residential and non-residential projects over the next three years. The loan can be repaid with cash or SRECs with a minimum floor price set by a competitive bid process that offers long-term SREC price certainty.

In addition to RPS acceleration and PSE&G's loan program, in January 2014, the Board of Public Utilities (BPU) officially approved nineteen grid-supply utility PV projects totaling 140 MW, all of which are scheduled to come on-line between 2014 and 2016. While this spate of approvals falls short of the 80 MW per year carve-out for grid-supply projects over the next three years, these projects will provide a steady stream of utility PV growth to balance volatile build rates in the commercial market.

New York: Lackluster Year Ends on a Positive Note

Figure 2.28 New York PV Installations by Market Segment, Q4 2011-Q4 2013



	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Residential	2.2	2.6	2.5	4.0	5.9	3.0	5.1	6.1	13.0
Non-Residential	6.9	4.6	5.6	6.8	17.4	3.1	5.7	6.7	26.7
Utility	37.0	0.0	4.8	0.0	9.1	0.0	0.0	0.0	0.0
Total	46.0	7.2	12.9	10.8	32.4	6.1	10.8	12.8	39.7

After several surprisingly disappointing quarters, New York's solar market surged in Q4 in both the residential and non-residential sectors. The **residential** sector grew from 6.1 MW in Q3 to 13 MW in Q4. Installers have repeatedly stated their optimistic outlook for New York, especially in all areas where the residential rebate is administered by NYSERDA (anywhere outside of Long Island). While many installers have made mention of the long six-week-plus wait time for incentive approval, they appreciate the transparency and predictability of NYSERDA's program. Installers are targeting middle- and upper-class areas, including Westchester County and the Albany area. The residential sector in LIPA territory also grew in Q4, up 86% quarter-over-quarter to 5.1 MW. Opinions about the opportunity on Long Island vary, as some large installers have been successful, while others report apparent customer favoritism toward local companies.

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New York has also begun to see some of the long-anticipated growth in the **non-residential** sector. In Q4, 26.7 MW of non-residential solar came on-line, up from 6.6 MW in Q3. The vast majority of this development was in NYSERDA-administered areas, which saw growth under both non-residential incentive programs:

- In mid- 2013, the maximum system size for NYSERDA's non-residential rebate was increased from 50 kW to 200 kW. Installed capacity of sub-200 kW systems rose 217% quarter-over-quarter in Q4 as many larger systems were completed.
- As discussed in previous iterations of this report, NYSERDA announced funding for 150 MW of large non-residential solar capacity (systems greater than 200 kW) through the first three rounds of its Competitive PV Program, which have completion deadlines between August 2013 and March 2014. Minimal siting and permitting requirements to earn this incentive led to a number of delayed or canceled projects due to overly aggressive incentive bids that resulted in a failure to secure financing and negotiate viable EPC pricing. Nonetheless, 15.4 MW from this program were completed in Q4 2013, compared to just 5.2 MW in the first three quarters of 2013 combined. We expect many more of these projects to spill over into 2014.

LIPA's feed-in tariff program has suffered from a double-edged sword of poor incentive program administration and poor due diligence by project developers. On one hand, developers drastically underestimated construction, permitting, and interconnection costs, and in some cases even secured agricultural land despite a restriction on such land-use development in Long Island. Many were therefore unable to complete projects that had signed contracts under the first 50 MW FIT program. Meanwhile, LIPA is increasing transparency regarding some of the costs that hindered development in the first program and implementing more stringent requirements in order to improve the success rate of projects under the second, 100 MW FIT program.

The current NY-Sun initiative, which includes all incentive programs mentioned above, expires at the end of 2015, but NYSERDA is already developing a new statewide PV program that could bring an additional 3 GW of solar to New York between 2016 and 2023. NYSERDA is awaiting approval for its proposed MW Block structure and a request for over $960 million in funding. If approved, we can expect a large share of this capacity to come on-line in 2016 prior to the expiration of the ITC.

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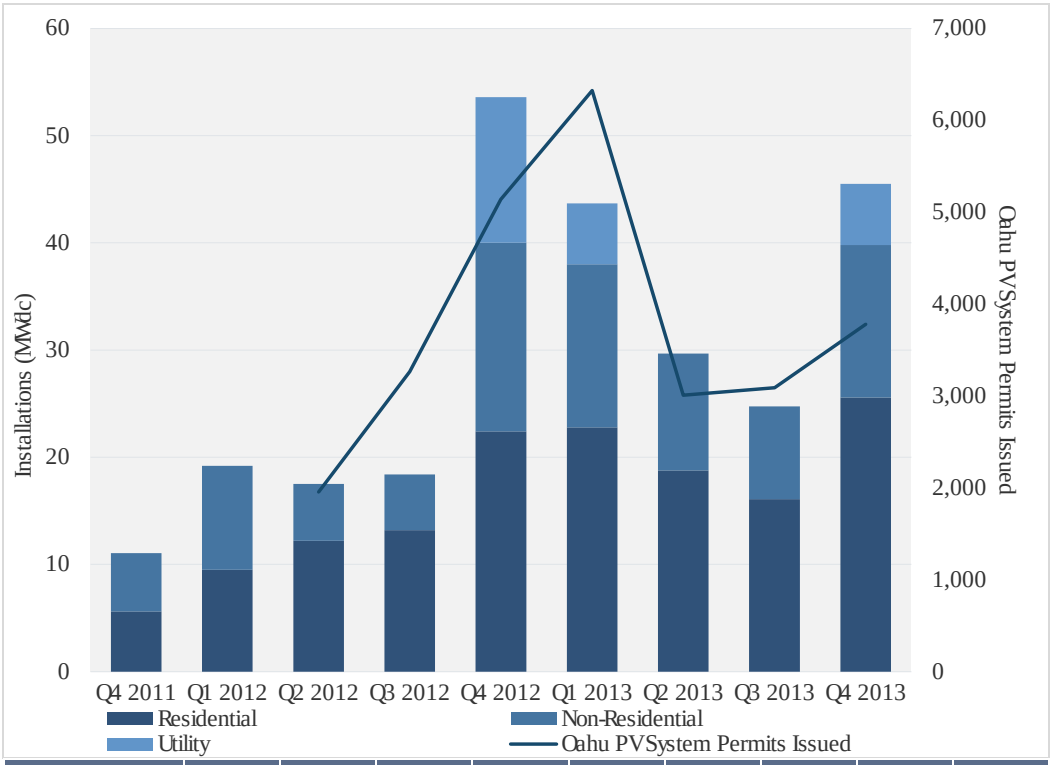
Hawaii: Market Mayhem Benefits Q4 2013, Brings Uncertainty Into 2014

Figure 2.29 Hawaii PV Installations by Market Segment vs. Oahu PV Permits Issued, Q4 2011-Q4 2013



	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Residential	5.6	9.5	12.2	13.2	22.4	22.8	18.8	16.1	27.8
Non-Residential	5.5	9.7	5.3	5.2	17.6	15.2	10.9	8.7	14.0
Utility	0.0	0.0	0.0	0.0	13.6	5.7	0.0	0.0	5.7
Total	11.1	19.2	17.5	18.4	53.6	43.7	29.7	24.7	47.5

After two consecutive quarters of market contraction, Hawaii experienced a significant rebound in Q4 2013 by adding 27.8 MW of **residential** installations and 14 MW of **non-residential** installations. On one hand, this growth aligns with the market's typical Q4 uptick in installations in order to maximize the federal and in-state tax credit. While the market has adjusted to revised state tax credit rules that limit the credit claimed to $5,000 for residential installations and $500,000 for non-residential installations, new PV customers have suffered from HECO's extensive interconnection approval process. For that reason, the Q4 installation spike deviated from many leading residential installers' outlook on the ground, where an increasing number of development opportunities have frozen in neighborhoods that reached PV penetration levels at or above 100% of daytime minimum load (DTL).

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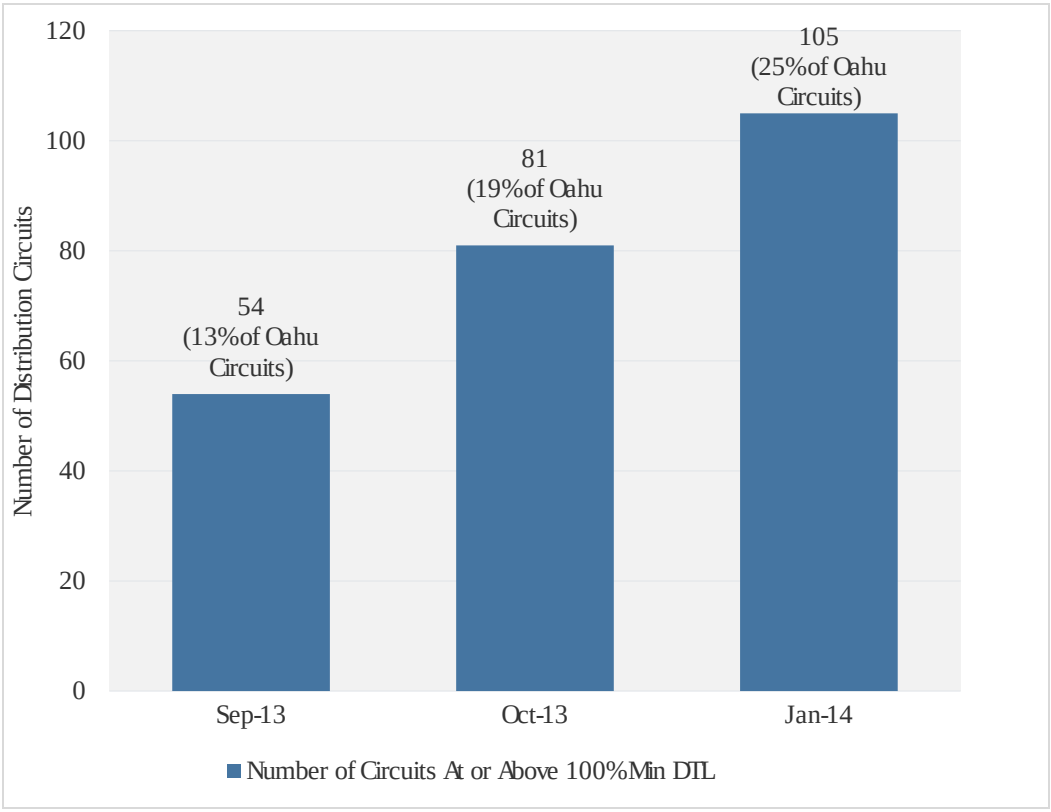
As of early September, HECO, which accounted for 80% of the market in Q4 2013, followed in the footsteps of MECO and HELCO by requiring all new PV customers to submit net metering agreements before proceeding with installation and issued new interconnection rules for solar customers in neighborhoods with high PV penetration levels. Specifically, a new solar customer with a system 10 kW or smaller may have to pay for equipment upgrades once PV circuit penetration is at 75% minimum DTL or higher. Meanwhile, customers with systems larger than 10 kW may have to pay for equipment upgrades regardless of the current PV grid saturation level. Lastly, interconnection studies will only be required for a new PV system if grid saturation has hit 100% minimum DTL, a threshold previously set at 75%.

While these rules have provided a framework for identifying circuits to review the technical feasibility and risks associated with reverse power flow scenarios, HECO does not have a universal threshold of PV generation that would automatically require equipment upgrades. Given these new rules, the following market trends provide added context as to why the uptick occurred in Q4, a possibility of additional pent-up demand remaining and spilling over into 1H 2014 (as was the case in 1H 2013), and why lead generation reflects the inevitable contraction to Hawaii's market in the second half of 2014:

- **Sluggish Approval of Customers' NEM Agreements Pushes Demand from Q3 into Q4:** Prior to the interconnection rule changes, customers would submit a NEM agreement as a last step in the development cycle after the installation was complete. In turn, a portion of projects that were expected to come on-line in September did not receive approval to interconnect until late Q4. The target pocket of demand that fit this profile would have been residential installations of less than 10 kW on circuits where PV penetration fell between 75% and 99% minimum DTL. Under this scenario, HECO would conduct a technical review (not to be confused with an extensive interconnection requirement study) of the circuit, which would delay interconnection by only five weeks if the circuit ultimately did not require an equipment upgrade.
- **Interconnection Approval Processes Extend Indefinitely:** In a number of PV-saturated neighborhoods, both in HECO and the other utility territories, a growing number of circuits are shifting from 75% to 100% minimum DTL. In these areas, customers are now being told that they may have to wait anywhere from six to eighteen months for an interconnection requirement study to take place. In turn, customers are often being stuck with sunk installation costs, their same high monthly electricity bill, and the possibility of paying for a share of equipment upgrades when the utility eventually determines whether and which upgrades are needed.

For added context, consider the following figure based on three HECO announcements, which reveals that the number of circuits with PV at or above 100% minimum DTL nearly doubled between September 2013 and January 2014 alone.

Figure 2.30 Number of Distribution Circuits on Oahu With PV Capacity at or Above 100% Minimum DTL, 2H 2013



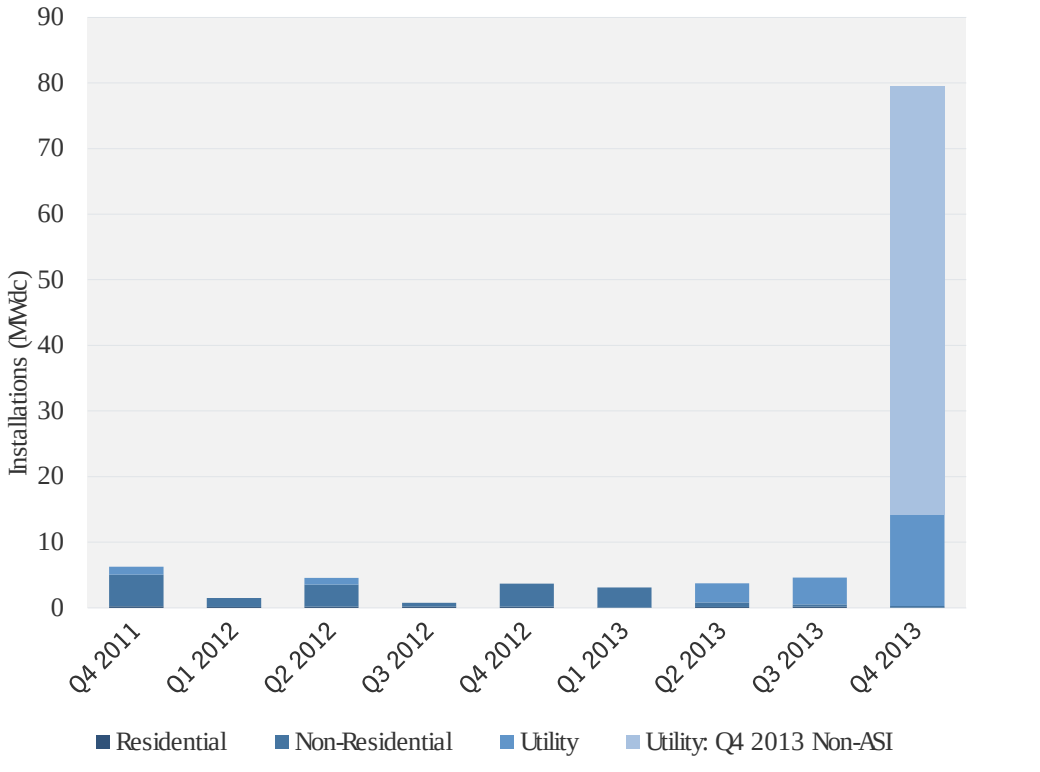
- **PV Systems Grandfathered in Under Old Interconnection Rules Began to Come On-Line in Q4 2013:** Installers were in the middle of completing hundreds of projects when HECO released its revised interconnection rules. In the middle of Q4 2013, HECO established a set of criteria that would allow customers with PV systems installed to come on-line if they provided evidence of having entered into a "financial commitment" with an installer to purchase or lease a PV system. Interconnection could then take place after the utility conducted a safety review of circuit penetration levels. Therefore, a portion of these projects with relatively expedited review processes accounted for a portion of the residential demand uptick. However, while a grandfathered-in customer would not have to pay for any equipment upgrades, the decision to add an upgrade would have pushed the interconnection date into 2014.
- **Installers Shift Investment Away From Saturated Residential Circuits to Non-Residential Projects:** A number of installers in Q4 2013 shifted their pipeline to non-residential projects where circuit penetration levels were below 75% of minimum DTL.

The backlog of secured DG customers entering 2014 is lower compared to the start of 2013, as evidenced by the total number of PV permits pulled on Oahu in 2013 dropping 20% year-over-

year. Meanwhile, a number of installers note that they have hundreds of customers in their backlog waiting to commence installation upon approval from HECO or one of the other two utilities. These conflicting trends suggest that at best, the first half of 2014 will benefit from a spillover of projects awaiting utility approval to proceed with installation. However, the lag time between customer acquisition and notice to proceed has forced a number of installers to lay off install crews and sales staff. In turn, the second half of 2014 is expected to suffer from installers not operating at full capacity throughout 2H 2013 into the beginning of 2014.

Georgia: Utility Procurement Programs Drive Growth

Figure 2.31 Georgia PV Installations by Market Segment, Q4 2011-Q4 2013



	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Residential	0.3	0.1	0.2	0.2	0.2	0.1	0.1	0.2	0.0
Non-Residential	4.8	1.4	3.4	0.6	3.5	3.0	0.7	0.3	0.3
Utility	1.2	0.0	1.0	0.0	0.0	0.0	2.9	4.1	79.2
Total	6.3	1.5	4.6	0.8	3.7	3.1	3.7	4.6	79.5

2013 marks Georgia's transition from a small state market to a leading source of demand in the U.S. Georgia is the only top-ten state market in 2013 without a Renewable Portfolio Standard. Instead, demand is primarily rooted in utility-led procurement programs spearheaded by the

state's major utility, Georgia Power. The utility kicked off its investment two years ago with the 60 MW Large-Scale Solar Initiative, followed by the 210 MW Advanced Solar Initiative (ASI), which began in 2013, and the newly established procurement program, ASI Prime, which calls for 525 MW of utility PV.

In April 2013, as part of the ASI program, Georgia Power held a lottery for 11 MW of small-scale solar projects (<100 kW) and 34 MW of medium-scale (101 kW to 1 MW), along with an RFP for 60 MW of utility-scale solar (1 MW to 20 MW). As ASI ramps up, it is important to note that any commercial or industrial project part of Georgia Power's small- and medium-scale programs falls under the "wholesale distributed generation" subcategory of utility-scale PV.

In 2013, the majority of growth took place in the final quarter, which added 79.2 MW of **utility PV** installations. As Figure 2.31 shows, 65.3 MW of capacity that came on-line in Q4 was external to the ASI program, coming from the Large-Scale Solar Initiative and a one-off PPA signed with a separate utility. Through the end of 2013, 18.2% of ASI's small-scale component and 42.3% of ASI's medium-scale component had come on-line. A majority of the remaining projects signed PPAs with Georgia Power in August 2013 and therefore had January 2014 interconnection deadlines, given the six-month window to come on-line under ASI program rules. However, 12 MW of the small- and medium-scale programs, plus 10 MW out of the 60 MW utility-scale RFP, all dropped out of ASI and will roll over into Georgia Power's 2014 procurement plans.

Under the arbitrary lottery selection process in place in the state, developers were incentivized to submit a high number of applications, yet were not required to demonstrate sufficient due diligence for each submission. Anecdotal discussions with developers reveal that delays came from several projects that struggled to secure financing or were sited on wetlands. As a result, Georgia Power is requiring projects bidding into the 2014 lottery to pay a $5/kW fee to ensure a qualified pool of project applicants. In addition, the 50 MW part of the utility-scale RFP is expected to come on-line at the end of 2014, since PPA negotiations were finalized in November 2013 and the required commercial operation date is January 1, 2015.

Lastly, the Georgia Public Service Commission has decided to add 525 MW of solar to Georgia Power's integrated resource plan for 2015 and 2016, otherwise known as ASI Prime. The 525 MW will be split into 100 MW of DG and 425 MW of utility-scale installations. The attractiveness of this second procurement plan will depend largely on whether the standard offer prices for DG and utility-scale projects remain at the same level as under the current ASI program.

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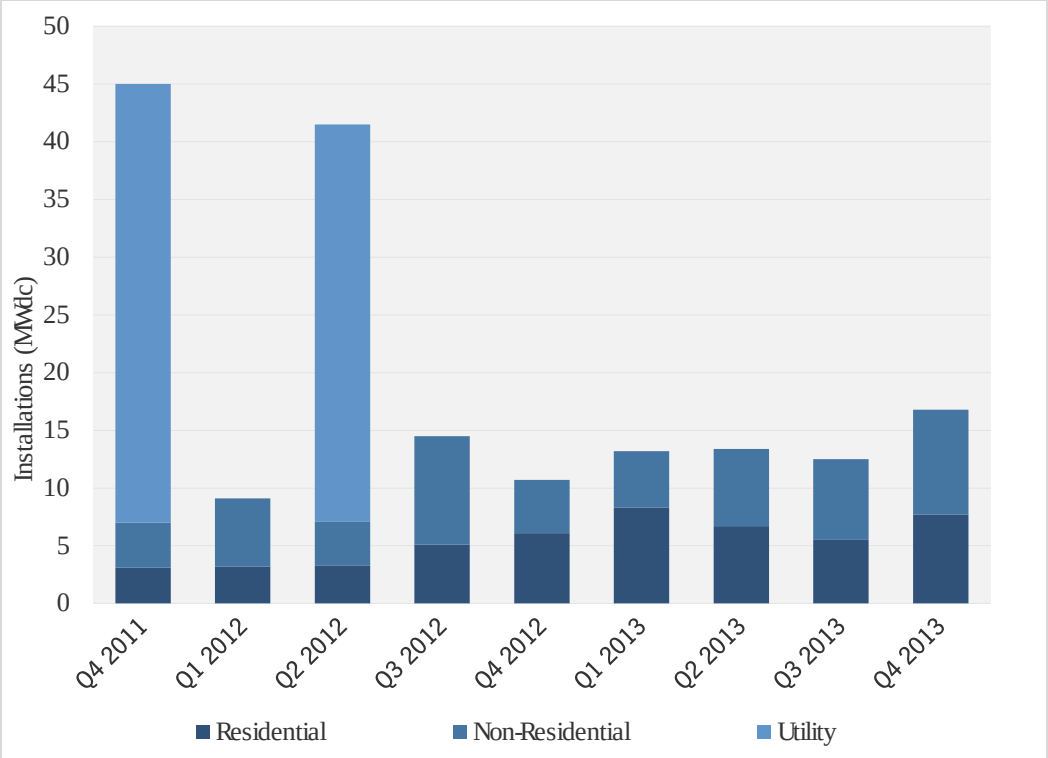
Colorado: Net Metering Battle Avoided – For Now

Figure 2.32 Colorado PV Installations by Market Segment, Q4 2011-Q4 2013



	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Residential	3.1	3.2	3.3	5.1	6.1	8.3	6.7	5.5	7.7
Non-Residential	3.9	5.9	3.8	9.4	4.6	4.9	6.7	7.0	9.1
Utility	38.0	0.0	34.4	0.0	0.0	0.0	0.0	0.0	0.0
Total	45.0	9.1	41.5	14.5	10.7	13.2	13.4	12.5	16.8

Unlike other established state markets that have shown glimpses of retail rate parity, Colorado's residential and non-residential markets continued to ebb and flow with the availability of incentives offered by Xcel Energy through its Solar*Rewards program. In 2013, the residential market grew 59% year-over-year, highlighted by 8.3 MW installed in Q1 2013. Xcel's residential incentive cap was then increased to 33 MW in April, and many of the projects that likely secured the rebate soon after this change came on-line in Q4. Following a similar pattern, the non-residential market grew to 9.1 MW in Q4, which is particularly notable given that non-residential incentives were exhausted in October. Three community solar installations also came on-line, for a total of 1.5 MW.

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We expect to see some spillover into 2014 of DG systems that secured incentives in the 2013 program, just as we saw some 2012 spillover of residential systems into Q1 2013. The outlook for the second half of 2014 is still somewhat unclear, as the PUC has yet to rule on Xcel's 2014 implementation plan, which has positive and negative implications depending on the market segment:

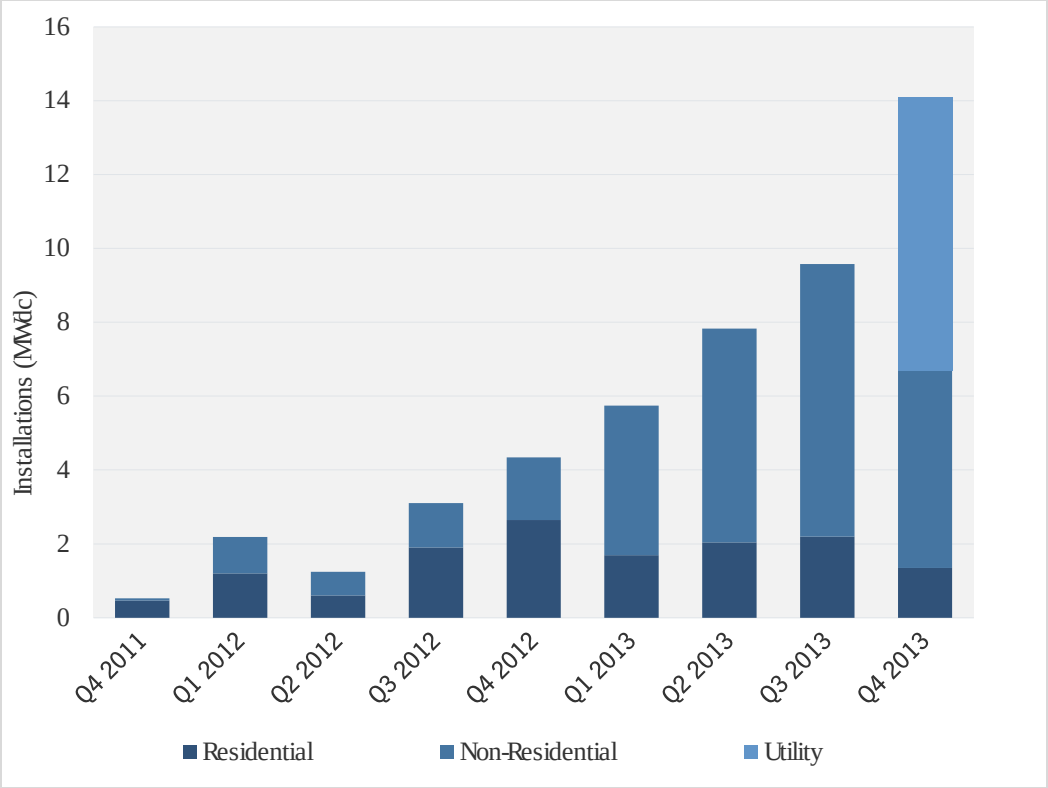
- Xcel's residential demand is lowered slightly relative to 2013. The proposal calls for 24 MW of small-scale solar, which is equal to the additional capacity added to 2013's compliance plan. However, the eligible system size would be increased from 10 kW to 25 kW, thereby opening up increased opportunity for investment in small-scale commercial.
- Non-residential demand will be driven by 12 MW of eligible solar for systems greater than 25 kW.
- The utility market will benefit from an additional 6.5 MW allocated for community solar gardens.

One thing that is certain is that, at least in 2014, Colorado will not face the net metering battle that many had feared. The PUC announced early this year that it would remove the possibility of any changes to net metering from its 2014 Compliance Plan docket.

No utility solar came on-line in 2013, and no bids were submitted in the U.S. Bureau of Land Management's first auction for development in designated Solar Energy Zones on public land, held in October. However, in December, Xcel Energy won the PUC's approval for the procurement of 170 MW of solar from two utility-scale projects. This is the first instance of a utility procuring solar based on cost-competitiveness alone, in this case as a hedge against rising natural gas prices, rather than to fulfill an RPS requirement.

Connecticut: A Market Primed for Growth

Figure 2.33 Connecticut PV Installations by Market Segment, Q4 2011-Q4 2013



	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Residential	0.5	1.2	0.6	1.9	2.6	1.7	2.0	2.2	1.4
Non-Residential	0.1	1.0	0.6	1.2	1.7	4.1	5.8	7.4	5.4
Utility	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.4
Total	0.5	2.2	1.2	3.1	4.3	5.7	7.8	9.6	14.1

Connecticut's solar market saw overall growth throughout 2013, though the distributed generation sectors declined slightly in Q4. The **residential** market dipped to 1.4 MW in Q4, down from 2.2 MW in Q3 and 2.6 MW in Q4 2012. This sector is driven largely by the timing of the Solarize Connecticut program, even more so than in Massachusetts. The majority of Solarize Connecticut systems installed in 2013 came on-line in Q2 and Q3. Installations outside of this program also declined in Q4 as Step 3 of the Residential Solar Investment Program (RSIP) wound down. Administered by the Clean Energy Finance and Investment Authority (CEFIA), the RSIP provides rebates to direct-owned residential PV systems and a PBI to third-party-owned systems. We do expect growth to resume this year as the program enters Step 4, which will provide incentives to 10 MW of residential installations in 2014. Some installers have expressed

concern, however, about a lower incentive rate coupled with rising module prices and the high administrative costs of the various state financing options.

On the **non-residential** side, installed capacity also fell, decreasing to 5.4 MW in Q4. Development and construction cycles are determined by the timeline of the Medium (100-250 kW) and Large (250-1,000 kW) ZREC RFP. The challenge associated with the limited annual solicitation period is the added delay between securing a customer and finding out if the project was selected in the RFP. Most non-residential solar capacity that was installed in 2013 was awarded during the 2012 solicitation, and additional winning bids for the two IOUs were announced in July 2013. A total of 90 Medium and 26 Large ZREC contracts were awarded, including contracts totaling approximately 24 MW for Connecticut Light and Power. These systems are expected to come on-line throughout 2014. One 7.4 MW **utility-scale** system was interconnected in Q4, and several more projects are in development for 2014, but the majority of Connecticut's solar market will be distributed generation.

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Figure 2.34 U.S. PV Installations by State and Market Segment

	Q4 2013				2013 Annual				Cumulative			
	Res	Non-Res	Utility	**Total**	Res	Non-Res	Utility	**Total**	Res	Non-Res	Utility	**Total**
Arizona	24.0	21.7	77.2	**122.9**	73	58	290	**421**	222	239	1,078	**1,539**
California	141.8	85.6	972.5	**1,199.9**	410	293	1,918	**2,621**	1,084	1,344	2,745	**5,172**
Colorado	7.7	9.1	-	**16.8**	28	28	-	**56**	94	131	107	**331**
Connecticut	1.4	5.4	7.4	**14.1**	7	23	7	**37**	25	41	7	**74**
Delaware	0.3	0.6	2.3	**3.2**	1	1	7	**9**	6	14	33	**53**
Florida	1.6	5.4	-	**7.0**	7	19	-	**26**	20	50	68	**138**
Georgia	0.0	0.3	79.2	**79.5**	0	4	86	**91**	2	24	90	**116**
Hawaii	27.8	14.0	5.7	**47.5**	85	49	11	**146**	180	128	27	**336**
Illinois	0.2	0.6	-	**0.8**	1	1	-	**2**	4	8	36	**48**
Indiana	0.1	0.2	45.4	**45.7**	0	3	51	**54**	0	3	51	**54**
Maryland	2.6	9.8	-	**12.4**	9	20	-	**29**	27	85	30	**142**
Massachusetts	6.2	95.3	17.2	**118.7**	27	178	33	**237**	55	333	52	**440**
Minnesota	0.2	1.0	-	**1.2**	0	3	2	**6**	3	9	2	**14**
Missouri	4.6	4.4	-	**8.9**	14	14	-	**28**	18	21	-	**39**
Nevada	0.4	3.4	-	**3.7**	1	8	38	**47**	8	45	333	**386**
New Jersey	9.2	54.8	-	**64.0**	38	189	9	**236**	165	883	163	**1,211**
New Hampshire	0.3	0.4	-	**0.7**	1	1	-	**2**	2	2	-	**4**
New Mexico	1.6	7.7	20.1	**29.4**	4	14	26	**45**	17	29	191	**236**
New York	13.0	26.7	-	**39.7**	27	42	-	**69**	74	122	51	**247**
North Carolina	0.7	31.0	137.2	**168.9**	2	57	276	**335**	10	97	450	**557**
Ohio	1.3	3.9	-	**5.1**	2	17	1	**21**	5	59	24	**88**
Oregon	1.8	0.6	-	**2.4**	6	2	-	**7**	25	35	16	**76**
Pennsylvania	1.8	8.1	-	**9.9**	10	28	-	**38**	50	163	22	**235**
Tennessee	0.2	0.4	-	**0.6**	2	18	5	**25**	8	49	18	**74**
Texas	3.2	2.0	59.6	**64.8**	9	6	60	**75**	29	26	146	**201**
Utah	0.4	0.8	-	**1.2**	1	2	-	**2**	7	11	-	**18**
Vermont	1.8	0.2	2.2	**4.2**	5	2	9	**16**	8	7	17	**32**
Virginia	0.3	3.7	-	**4.0**	2	4	-	**6**	7	8	-	**15**
Washington	1.7	0.2	-	**1.8**	7	1	-	**8**	17	7	-	**24**
Washington, D.C.	0.5	0.7	-	**1.2**	1	1	-	**2**	5	2	-	**7**
Wisconsin	0.4	0.2	1.1	**1.7**	1	1	1	**3**	6	10	1	**17**
Other	2.1	6.8	14.9	**23.8**	8	26	16	**50**	42	68	46	**155**
Total	259	405	1,442	**2,106**	792	1,112	2,847	**4,751**	2,218	4,044	5,802	**12,079**

For NSD Survey Respondents Only

Figure 2.35 State PV Installation Rankings, 2012-2014

State	Rank (2012)	Rank (2013)	Installations (2012)	Installations (2013)	Installation Forecast (2014E)	Rank (2014E)
California	1	1	1,046	2,621	2,515	1
Arizona	2	2	719	421	389	3
North Carolina	6	3	124	335	335	4
Massachusetts	5	4	134	237	332	5
New Jersey	3	5	419	236	389	2
Hawaii	7	6	109	146	144	8
Georgia	22	7	11	91	118	10
Texas	12	8	51	75	166	6
New York	10	9	63	69	160	7
Colorado	9	10	76	56	110	11
Indiana	30	11	-	54	62	18
Nevada	4	12	198	47	85	13
New Mexico	18	13	24	45	124	9
Pennsylvania	11	14	54	38	105	12
Connecticut	21	15	11	37	65	17
Maryland	8	16	79	29	66	15
Missouri	23	17	7	28	54	20
Florida	17	18	24	26	66	16
Tennessee	14	19	27	25	85	14
Ohio	16	20	25	21	54	19
Vermont	20	21	12	16	20	26
Delaware	19	22	18	9	20	25
Washington	25	23	4	8	29	22
Oregon	15	24	27	7	29	21
Minnesota	24	25	4	6	15	29
Virginia	30	26	-	6	21	24
Wisconsin	28	27	1	3	16	27
Utah	29	28	1	2	16	28
Washington, D.C.	27	29	1	2	9	30
New Hampshire	26	30	2	2	9	30
Illinois	13	31	30	2	26	23

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2.2. Number of Installations

Figure 2.36 Number of U.S. PV Installations

	Q4 2013				Total 2013				Cumulative			
	Res	Non-Res	Util	Total	Res	Non-Res	Util	Total	Res	Non-Res	Util	Total
AZ	3,223	117	20	3,360	9,945	314	28	10,287	32,976	1,827	97	34,900
CA	24,591	621	24	25,236	71,078	1,871	52	73,001	214,243	11,349	128	225,720
CO	1,373	138	-	1,511	4,546	390	-	4,936	16,832	1,577	7	18,416
CT	190	19	1	210	1,029	98	1	1,128	3,928	343	1	4,272
DE	38	6	1	45	152	39	2	193	1,066	189	4	1,259
FL	193	55	-	248	965	388	-	1,353	5,348	1,050	7	6,405
GA	4	8	37	49	58	34	43	135	418	253	43	714
HI	4,962	202	1	5,165	17,571	733	2	18,306	39,097	1,874	7	40,978
IL	29	6	-	35	112	32	-	144	854	158	4	1,016
IN	14	2	2	18	69	26	4	99	69	26	4	99
MD	359	27	-	386	1,314	141	-	1,455	4,314	619	2	4,935
MA	982	93	5	1,080	4,261	365	10	4,636	9,090	1,646	19	10,755
MN	32	25	-	57	60	36	1	97	462	282	1	745
MO	381	203	-	584	1,282	561	-	1,843	1,660	709	-	2,369
NV	51	35	-	86	161	58	1	220	1,487	588	9	2,084
NH	44	17	-	61	179	33	-	212	179	33	-	212
NJ	1,281	258	-	1,539	4,584	1,534	5	6,123	20,018	5,420	74	25,512
NM	246	11	3	260	782	61	6	849	3,484	278	22	3,784
NY	1,758	234	-	1,992	3,695	553	-	4,248	11,694	2,737	6	14,437
NC	136	19	24	179	465	43	66	574	1,609	226	126	1,961
OH	143	46	-	189	265	85	1	351	800	335	6	1,141
OR	351	41	-	392	1,132	74	-	1,206	6,741	626	6	7,373
PA	217	47	-	264	1,257	173	-	1,430	6,790	2,232	4	9,026
TN	29	20	-	49	221	176	3	400	580	543	7	1,130
TX	505	58	2	565	1,459	138	2	1,599	5,165	695	17	5,877
UT	135	19	-	154	188	24	-	212	1,995	296	-	2,291
VT	295	10	1	306	766	61	5	832	1,436	204	10	1,650
VA	62	6	-	68	307	15	-	322	1,326	177	-	322
WA	314	15	-	329	1,453	47	-	1,500	3,526	235	-	3,761
D.C.	71	12	-	83	216	18	-	234	487	30	-	517
WI	89	6	1	96	197	20	1	218	1,196	460	1	1,657

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	Q4 2013				Total 2013				Cumulative			
Other	356	59	4	419	1,454	269	8	1,731	9,115	955	20	10,090
Total	42,454	2,435	126	45,015	131,223	8,410	241	139,874	407,985	37,972	632	445,408

2.3. Installation Forecast

Our forecast is built off of a mixture of broad assumptions and specific market analysis. We begin by making a number of general, national assumptions. Specifically, we assume:

1. The Investment Tax Credit (ITC) remains in place through 2016 with no changes in the interim and no reemergence of the Section 1603 Treasury Program.
2. Project finance, particularly tax equity, remains tight but available, with financing terms improving incrementally over time.
3. The landscape of renewable portfolio standards at the state level remains mostly fixed, and no national RPS or RES is passed into law.
4. Net metering caps continue to be expanded, or net metering revisions are designed so as not to create a bottleneck in the market.
5. System prices will continue to decline at a rate forecasted by GTM Research.

Beyond this, we build our forecast for each market segment in each state individually according to the characteristics and dynamics of that state market. Our forecast assumes that no new state-level incentives will be introduced; instead, we anticipate that projects will increasingly be installed with only the ITC, accelerated depreciation, and net metering for DG systems. We examine this trend at the state level and predict the tipping point of demand in each state.

2014 Forecast

For 2014, our forecast calls for 26% overall growth in the U.S. solar market, with installations reaching 5,982 MW. We expect growth in all three segments, though at differing magnitudes:

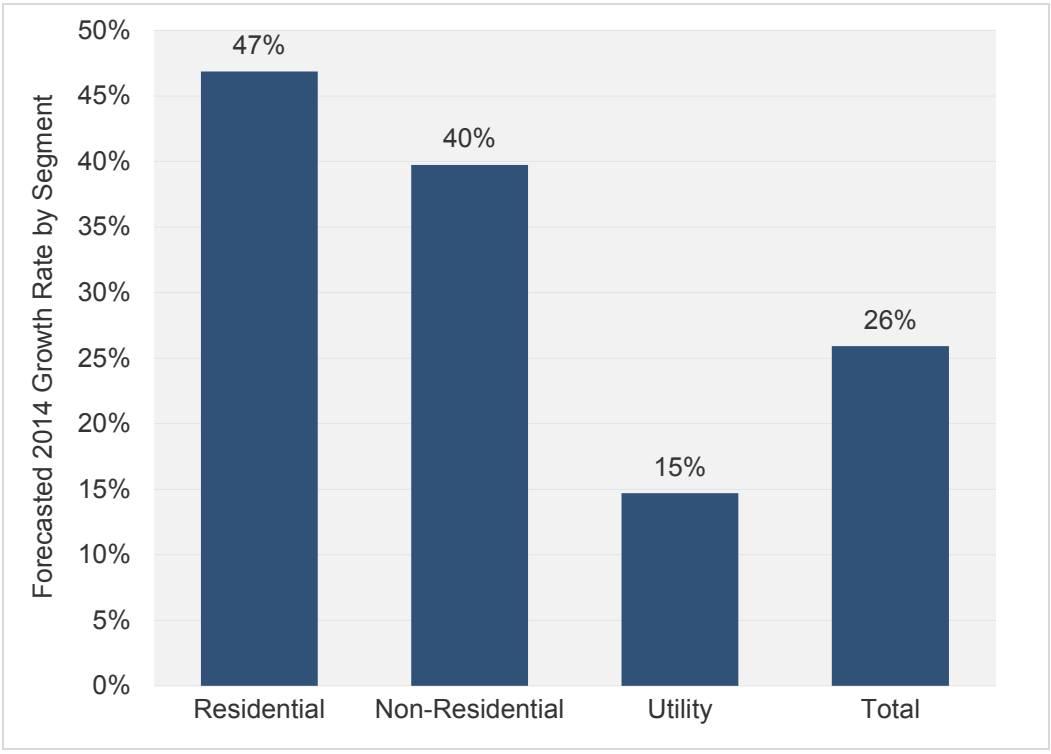
- **Residential** – We forecast 47% growth in the residential market, more than any other segment, with installations reaching 1,163 MW in 2014. California will continue to be the primary driver of residential solar installations and will grow 43% itself, but will be outpaced by the expansion of other states, which will grow 51% in aggregate. There will be some headwinds in the residential market, most notably in Hawaii (which we expect to decline in 2014), but overall the residential market will continue to show strength throughout the year. Battles over net energy metering and rate design will surely continue, but if early successes are indicative of future outcomes, we expect these challenges to have minimal impact on the market in 2014**.**
- **Non-Residential** – After a virtually flat 2013, we expect the non-residential market to come roaring back in 2014, growing 40% to reach 1,554 MW. This growth is reliant on strength in the California, Massachusetts, and New Jersey markets in particular. To a lesser extent, our bullish expectations for New York, Arizona, Colorado and Pennsylvania will also contribute. Non-residential system prices have declined impressively where necessary, and the

expansion of new financing options should continue to support growth despite tight overall margins.

- **Utility** – The utility market will see the least annual growth in 2014, increasing 15% to reach 3,265 MW. This is primarily a function of the project pipeline, which is more heavily weighted toward 2015 and 2016 (4.1 GW and 4.7 GW, respectively) than toward 2014. Apart from continued build-out of the large centralized projects in California and Arizona, we expect to see another banner year for North Carolina, over 100 MW of installations from Georgia's Advanced Solar Initiative, 129 MW of utility solar in Texas, and the first wave of long-overdue project completions in Puerto Rico.

As the year progresses, we will be monitoring each market closely. We will be particularly alert for signs of even more rapid growth in the residential market, which could exceed our expectations if circumstances allow. Conversely, we will be carefully watching the non-residential market, where our bullish forecast could prove to suggest too rapid a turnaround.

Figure 2.37 2014 Growth Forecast by Segment



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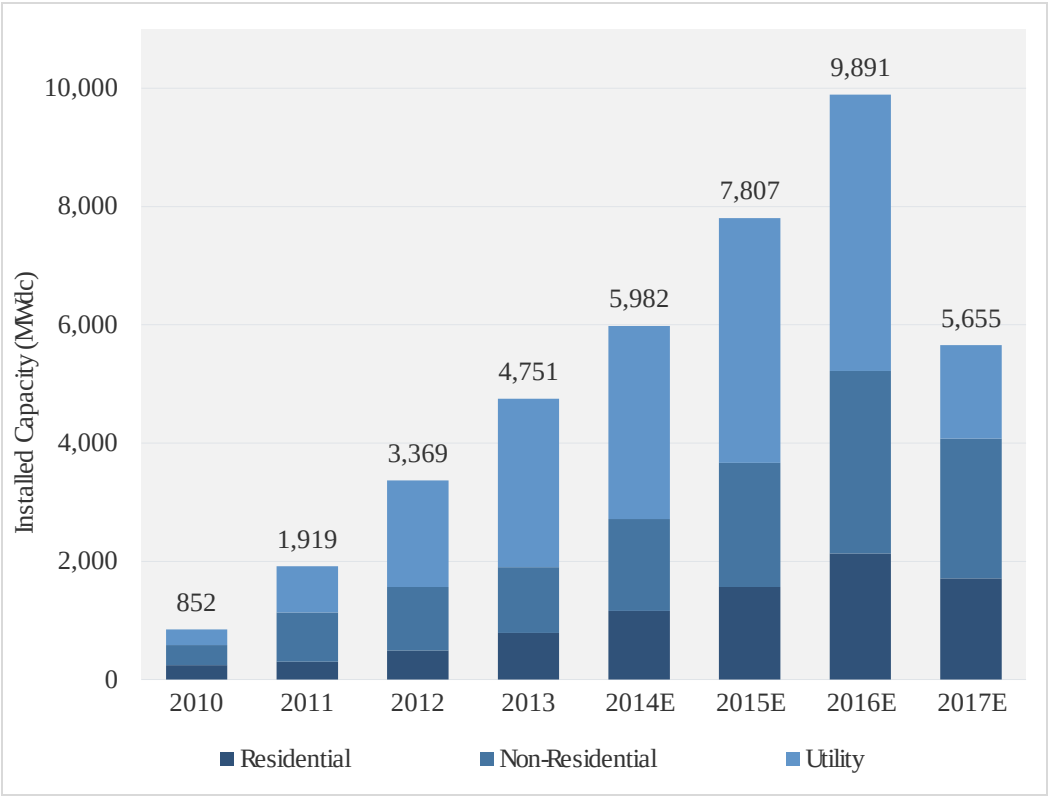
2015-2017

This quarter, we have revised our 2015-2017 forecasts up slightly, largely as a result of stronger expectations for the residential market. In addition, updated timelines for a variety of utility solar projects have led to an increase in that market in 2016. We continue to expect that the expiration of the 30% Investment Tax Credit will result in a market decline in 2017 to below 2014 levels. However, it is important to note that this decline will be driven primarily by the utility market (down 66% from 2016) rather than the residential and non-residential segments (down 20% and 23%, respectively). This is already evident in the utility market – very few projects are slated for 2017 completion, and some developers have even discussed building projects with "merchant noses," a structure wherein a project is completed in 2016 and sells power on the spot market until its PPA officially begins in or after 2017.

Figure 2.38 U.S. PV Installation Forecast, 2010-2017



Market Segment	2010	2011	2012	2013E	2014E	2015E	2016E	2017E
Residential	246	304	494	792	1,163	1,567	2,135	1,713
Non-Residential	339	831	1,072	1,112	1,554	2,100	3,085	2,363
Utility	267	784	1,803	2,847	3,265	4,140	4,671	1,579
Total	852	1,919	3,369	4,751	5,982	7,807	9,891	5,655

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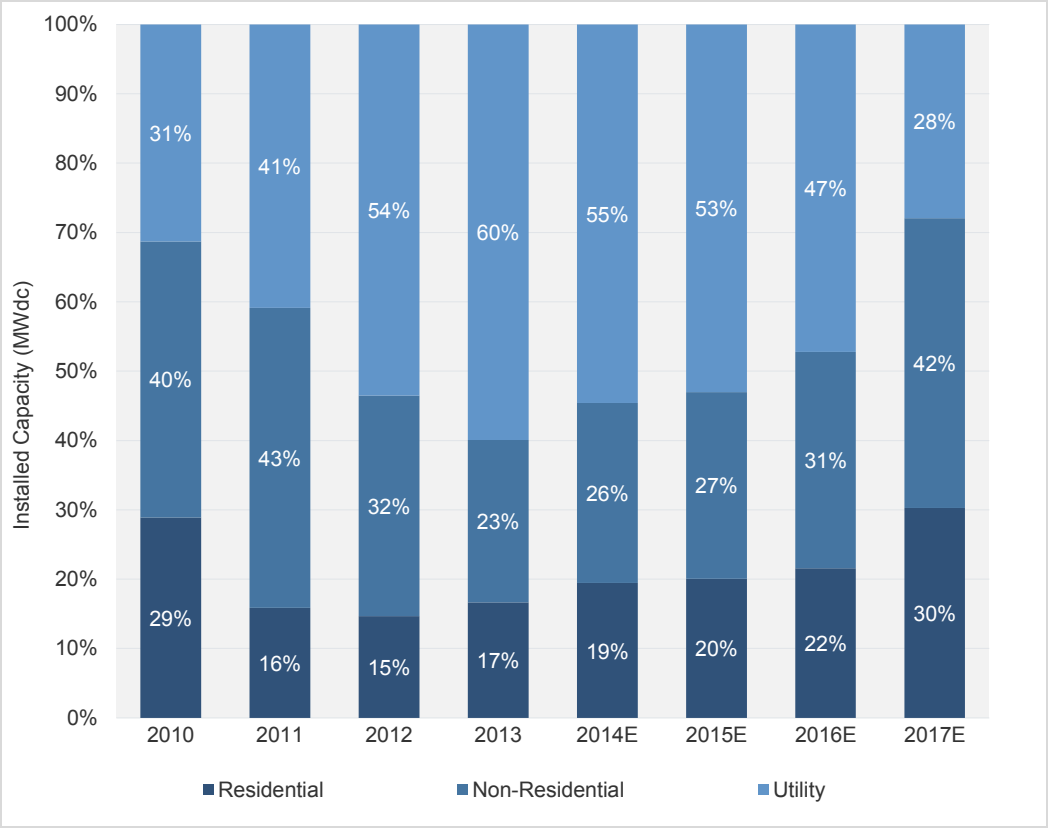
Figure 2.39 PV Installation Forecast by Market Segment, 2010-2017



2.3.1. Detailed Forecast Tables

For NSD Survey Respondents Only

Figure 2.40 Residential PV Installation Forecast, 2010-2017

State	2010	2011	2012	2013	2014E	2015E	2016E	2017E
Arizona	32	32	62	73	98	125	166	150
California	104	128	196	410	585	705	828	695
Colorado	19	14	18	28	36	45	70	65
Connecticut	3	3	6	7	17	24	31	22
Delaware	1	2	1	1	5	10	14	10
Florida	3	1	5	7	15	25	62	48
Georgia	0	1	1	0	4	10	20	14
Hawaii	8	21	57	85	64	80	88	75
Illinois	0	1	1	1	4	11	33	24
Indiana	-	-	-	0	2	4	9	7
Maryland	2	6	8	9	16	24	37	23
Massachusetts	2	5	15	27	38	55	60	52
Minnesota	1	0	1	0	4	6	12	8
Missouri	-	1	3	14	20	28	35	27
Nevada	1	1	0	1	5	12	28	13
New Hampshire	-	-	1	1	3	7	17	12
New Jersey	20	35	43	38	54	68	90	77
New Mexico	3	5	4	4	7	15	30	19
New York	12	8	15	27	54	75	91	71
North Carolina	0	2	1	2	7	16	34	18
Ohio	0	1	1	2	6	15	31	20
Oregon	4	4	6	6	10	18	25	21
Pennsylvania	14	17	7	10	19	29	38	34
Tennessee	-	1	3	2	5	6	8	7
Texas	3	5	8	9	18	31	55	52
Utah	-	0	0	1	4	12	19	9
Vermont	-	2	2	5	10	18	27	14
Virginia	-	-	-	2	4	10	19	16
Washington	2	3	3	7	14	20	31	28
Washington, D.C.	1	1	1	1	4	8	16	10
Wisconsin	1	2	0	1	6	10	20	7
Other	7	5	21	8	25	45	91	65
Total	246	304	494	792	1,163	1,567	2,135	1,713

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Figure 2.41 Non-Residential PV Installation Forecast, 2010-2017

State	2010	2011	2012	2013	2014E	2015E	2016E	2017E
Arizona	22	76	64	58	70	91	144	120
California	90	216	307	293	395	585	780	702
Colorado	16	33	24	28	41	55	95	78
Connecticut	2	2	5	23	33	40	49	44
Delaware	2	8	2	1	5	10	21	15
Florida	5	5	14	19	29	45	70	55
Georgia	4	7	9	4	7	9	13	12
Hawaii	7	18	38	49	45	58	75	70
Illinois	0	1	4	1	4	16	41	20
Indiana	-	0	0	3	7	15	25	23
Maryland	5	16	41	20	28	35	48	39
Massachusetts	14	23	108	178	235	195	290	210
Minnesota	1	1	3	3	11	25	29	18
Missouri	-	3	4	14	21	29	35	20
Nevada	5	18	7	8	17	30	44	30
New Hampshire	-	0	1	1	6	13	18	5
New Jersey	89	226	300	189	265	325	430	395
New Mexico	5	4	4	14	17	28	51	16
New York	10	15	34	42	75	121	192	101
North Carolina	4	26	2	57	20	25	35	32
Ohio	7	20	13	17	30	45	74	29
Oregon	5	10	11	2	5	12	25	27
Pennsylvania	32	70	30	28	45	55	79	55
Tennessee	1	12	15	18	27	43	75	39
Texas	3	5	7	6	19	35	78	75
Utah	-	0	0	2	6	13	32	9
Vermont	-	3	2	2	7	18	32	15
Virginia	-	0	0	4	8	19	31	21
Washington	0	2	1	1	5	12	20	7
Washington, D.C.	0	1	0	1	5	9	13	7
Wisconsin	2	3	1	1	5	11	18	10
Other	6	6	23	26	61	78	122	64
Total	337	831	1,072	1,112	1,554	2,100	3,085	2,363

For NSD Survey Respondents Only

Figure 2.42 Utility PV Installation Forecast, 2010-2017

State	2010	2011	2012	2013	2014E	2015E	2016E	2017E
Arizona	9	182	592	290	221	235	74	37
California	22	233	542	1,918	1,535	1,954	2,058	514
Colorado	19	45	34	-	33	100	140	70
Connecticut	-	-	-	7	15	10	12	8
Delaware	-	11	15	7	10	12	-	-
Florida	27	8	5	-	22	55	95	67
Georgia	-	2	1	86	107	190	395	119
Hawaii	1	1	14	11	35	130	112	56
Illinois	10	-	26	0	18	23	-	-
Indiana	-	-	-	51	53	50	30	-
Maryland	-	-	30	-	22	20	-	-
Massachusetts	5	3	11	33	59	41	60	24
Minnesota				2	0	25	48	34
Missouri			-	-	13	17	-	-
Nevada	55	24	191	38	63	437	453	68
New Hampshire				-	-	-	-	-
New Jersey	24	52	76	9	70	67	113	45
New Mexico	35	114	15	26	100	55	60	42
New York	-	37	14	0	31	55	81	32
North Carolina	26	27	121	276	308	344	341	170
Ohio	12	-	11	1	18	6	-	-
Oregon	2	3	10	-	14	16	-	-
Pennsylvania	1	-	18	-	41	31	-	-
Tennessee	3	5	9	5	53	9	-	-
Texas	16	34	36	60	129	81	300	90
Utah				-	6	-	-	-
Vermont	-	-	8	9	3	10	-	-
Virginia	-	-	-	-	9	7	10	-
Washington	-	-	-	-	10	14	-	-
Washington, D.C.			-	-	-	-	-	-
Wisconsin	-	-	-	1	5	7	-	-
Other	2	3	25	16	261	140	290	203
Total	269	784	1,803	2,847	3,265	4,140	4,671	1,579

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Figure 2.43 Total PV Installation Forecast, 2010-2017

State	2010	2011	2012	2013	2014E	2015E	2016E	2017E
Arizona	63	290	719	421	389	451	385	307
California	216	577	1,046	2,621	2,515	3,244	3,666	1,911
Colorado	54	92	76	56	110	200	305	213
Connecticut	5	4	11	37	65	74	92	74
Delaware	2	20	18	9	20	32	34	25
Florida	35	14	24	26	66	125	227	170
Georgia	4	10	11	91	118	208	427	145
Hawaii	16	40	109	146	144	268	275	201
Illinois	11	1	30	2	26	50	74	44
Indiana	-	-	-	54	62	69	64	30
Maryland	8	22	79	29	66	79	85	62
Massachusetts	22	31	134	237	332	291	410	286
Minnesota	2	2	4.0	6	15	56	89	60
Missouri	-	3	7	28	54	74	70	47
Nevada	61	44	198	47	85	479	524	111
New Hampshire	-	-	2	2	9	20	35	17
New Jersey	132	313	419	236	389	460	633	517
New Mexico	43	123	24	45	124	98	141	77
New York	23	60	63	69	160	251	364	205
North Carolina	31	55	124	335	335	385	410	220
Ohio	19	21	25	21	54	66	105	49
Oregon	11	18	27	7	29	46	50	48
Pennsylvania	47	88	54	38	105	115	117	89
Tennessee	3	18	27	25	85	58	83	46
Texas	23	44	51	75	166	147	433	217
Utah	-	0	1	2	16	25	51	18
Vermont	-	5	12	16	20	46	60	29
Virginia	-	-	-	6	21	36	60	37
Washington	3	5	4	8	29	46	51	35
Washington, D.C.	1	2	1	2	9	17	29	17
Wisconsin	3	5	1	3	16	28	38	17
Other	15	13	69	50	347	263	503	332
Total	852.0	1,919	3,369	4,751	5,982	7,807	9,891	5,655

2.4. Installed Price

This Year-in-Review marks the last time we will be reporting average system pricing by state. Since the inception of the Solar Market Insight report series, we have used weighted average pricing directly from state and utility solar programs. However, we have long felt that this data did not sufficiently reflect the current state of system pricing, as it often represented systems quoted in quarters well ahead of the installation date.

In an effort to ensure that the data reported is timely and accurate for industry assessments, we will be switching to a bottoms-up methodology based on tracked wholesale pricing of major solar components and data collected from major installers. Starting in the Q1 2014 report, we will present national average system pricing for each market segment broken down by major solar component with discussion on regional differences in pricing.

2013 ranks as another banner year for average installed price reductions across all market segments in the U.S.

Quarter-over-quarter, the national average system price declined by 15%, falling from $3.05/W in Q3 to $2.59/W in Q4, while dropping 14.8% from $3.04/W a year earlier. This capacity-weighted number is heavily impacted by the volume of utility-scale solar installed in a given quarter. Utility PV capacity accounted for more than two-thirds of all new capacity installed in Q4, and for that reason, had a relatively larger impact on the blended average system price. Individually, the residential, non-residential, and utility segments all saw price decreases on a quarter-over-quarter basis. (It should be noted that prices reported in this section are weighted averages based on all systems that were completed in Q4 across many locations and that the weight of any individual location can influence the average.)

- From Q4 2012 to Q4 2013, **residential** system prices fell 8.8% percent, from $5.03/W to $4.59/W. Quarter-over-quarter, installed prices declined by 3.2% percent. Installed prices came down in most major residential markets including California, Arizona, New Jersey, and New York.
- **Non-residential** system prices fell by an impressive 16.3% percent year-over-year, from $4.26/W to $3.57/W, while quarter-over-quarter installed costs decreased by 11%. Higher-priced school and government projects with prevailing wage requirements drove up average installed costs in Arizona's non-residential market. Amidst this uptick, however, the non-residential market on the whole benefited from an influx in large ground-mount systems completed in Massachusetts and New Jersey, with $3.00/W *average* installed prices and prices that ranged as low as $1.94/W.
- **Utility** system prices once again declined quarter-over-quarter and year-over-year, down from $2.27/W in Q4 2012 and $2.04/W in Q3 2013, settling at $1.96/W in Q4 2013.

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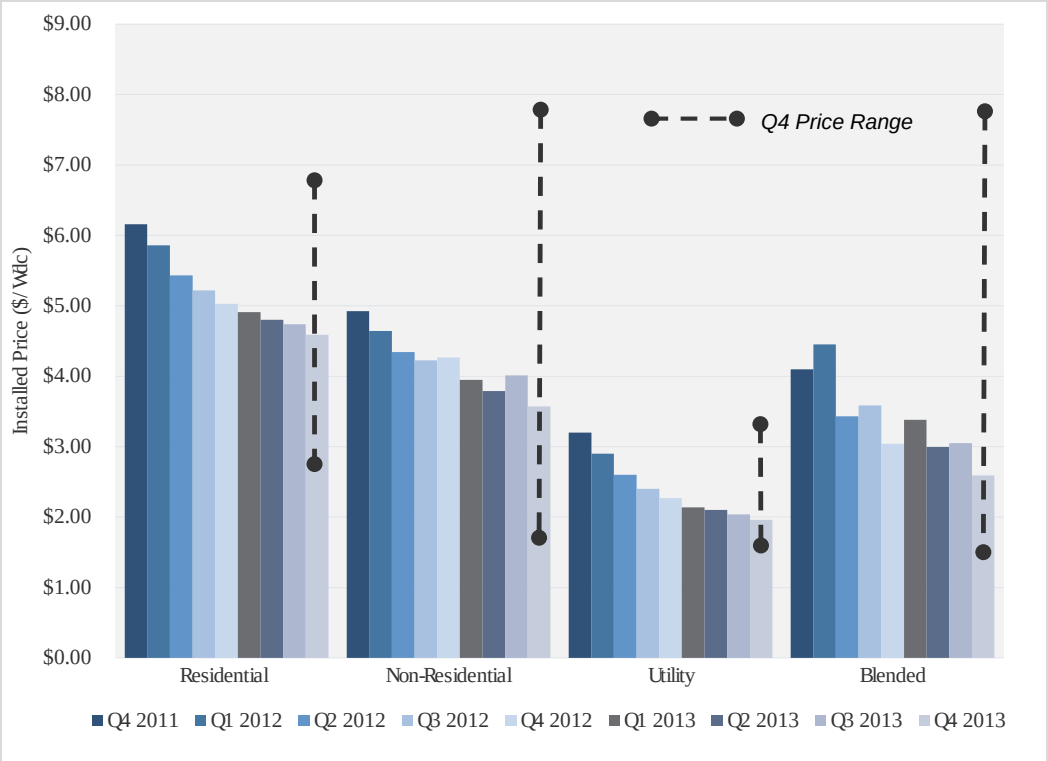
On the whole, installed PV prices vary greatly not only state to state, but also project to project. Common residential system prices ranged from less than $3.00/W to just under $7.00/W. Non-residential prices hit levels as low as $1.70/W, increasing up to almost $8.00/W. Utility prices also display high variability: a 50-MW-plus fixed-tilt installation will be significantly less expensive than a 1 MW pilot project that employs dual-axis tracking. (Note that the lowest installed cost per watt does not necessarily yield the lowest levelized cost of energy, an important metric for measuring project returns, and one that is heavily influenced by the project's energy production.)

Figure 2.44 Average Installed Price by Market Segment, Q4 2011-Q4 2013



Installed Price ($/Wdc)	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Residential	$6.16	$5.86	$5.43	$5.22	$5.03	$4.91	$4.80	$4.74	$4.59
Non-Residential	$4.92	$4.64	$4.35	$4.22	$4.26	$3.95	$3.79	$4.01	$3.57
Utility	$3.20	$2.90	$2.60	$2.40	$2.27	$2.14	$2.10	$2.04	$1.96
Total	$4.10	$4.45	$3.43	$3.59	$3.04	$3.38	$3.00	$3.05	$2.59

Reviewing system prices on a state-by-state basis further reveals just how fractured the domestic market is in terms of pricing. Even within a single state, installed costs can vary by more than $2.00/W. There is a substantial difference in pricing between smaller, local integrators and large, multistate developers that generally offer lower prices. Therefore, it should be noted that systems have been installed in each state for well below (and above) the average pricing displayed in

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Figure 2.44. Generally, however, overarching trends between states can be discerned from quarter to quarter.

Figure 2.45 Installed PV Pricing by State, Q3 2013-Q4 2013

	Q3 2013			Q4 2013		
Average Installed Price ($/Wdc)	Residential	Non-Residential	Utility	Residential	Non-Residential	Utility
Arizona	$4.46	$5.02		$4.27	$5.51	
California	$4.94	$4.28		$4.83	$3.84	
Colorado	$4.65	$4.04		$4.60	$4.13	
Connecticut	$4.30	$4.07		$4.49	$4.00	
Delaware	$3.53	$3.98		$3.49	$3.92	
Florida	$3.23	$2.98		$3.64	$2.35	
Georgia	$4.28	$3.20		$4.10	$3.13	
Hawaii	$4.18	$4.01		$3.70	$3.66	
Illinois	$4.74	$3.74		$4.55	$3.92	
Indiana	$4.84	$3.82		$4.69	$4.04	
Maryland	$4.64	$3.30		$4.48	$3.34	
Massachusetts	$5.97	$3.27		$5.70	$3.07	
Minnesota	$6.02	$7.46		$4.51	$4.72	
Missouri	$3.92	$3.57		$3.88	$3.67	
Nevada	$3.92	$3.57		$3.93	$3.19	
New Hampshire	$5.22	$4.53	$2.04	$5.06	$4.33	$1.96
New Jersey	$3.96	$2.68		$3.92	$2.59	
New Mexico	$4.79	$3.96		$4.86	$3.84	
New York	$4.95	$5.15		$4.89	$4.90	
North Carolina	$4.53	$3.65		$4.44	$3.50	
Ohio	$4.48	$3.32		$4.37	$3.27	
Oregon	$5.45	$5.49		$5.40	$3.92	
Pennsylvania	$3.84	$4.61		$3.89	$2.95	
Tennessee	$4.75	$4.56		$4.75	$4.56	
Texas	$3.67	$3.72		$3.74	$3.97	
Utah	$5.10	$4.13		$5.02	$4.13	
Vermont	$4.55	$3.18		$4.55	$3.24	
Virginia	$4.15	$3.94		$4.08	$3.70	
Washington	$5.45	$5.51		$5.40	$4.92	
Washington, D.C.	$4.10	$2.92		$3.75	$2.94	

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	Q3 2013			Q4 2013		
Wisconsin	$3.49	$3.22		$2.94	$3.05	
Other	$5.09	$4.39		$4.92	$4.18	

In established markets, Q4 2013 average residential pricing ranged from $3.92/W to $5.70/W. Non-residential pricing ranged from slightly more than $2.59/W to over $4.13/W. (It should be noted that non-residential projects can range from as small as sub-10 kW to in excess of 1 megawatt, and this can significantly affect a particular state's average.)

There are four first-order drivers of state-level system pricing other than component costs: market maturity, labor costs, "soft" costs, and system size.

- **Market maturity:** The more established and larger a state market is, the more likely it is to attract larger, experienced project developers that can offer lower system prices. Conversely, newer markets are generally more reliant on smaller integrators that purchase components through distributors and have less procedural standardization.
- **Labor costs:** States with higher labor costs will tend to have higher system costs and vice versa. However, this variance is somewhat limited by the fact that direct labor currently constitutes less than 15% of total system costs.
- **Soft costs:** Factors such as permitting, interconnection, incentive applications, financing, and other fees play a major role in determining system prices. The more complex and time-consuming these factors are in a given market, the more expensive system prices will be. Most notably, as equipment costs fall, installers have noted that significant potential soft-cost reductions can be made in the domain of customer acquisition.
- **System size:** Larger average system sizes result in lower installed prices per watt. This is true in both the residential and non-residential segments.

The following three figures offer visibility into the range of average installed prices across each state and market segment, along with national installed pricing trends by system size.

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Figure 2.46 Average Residential Installed Price by State, Q4 2013

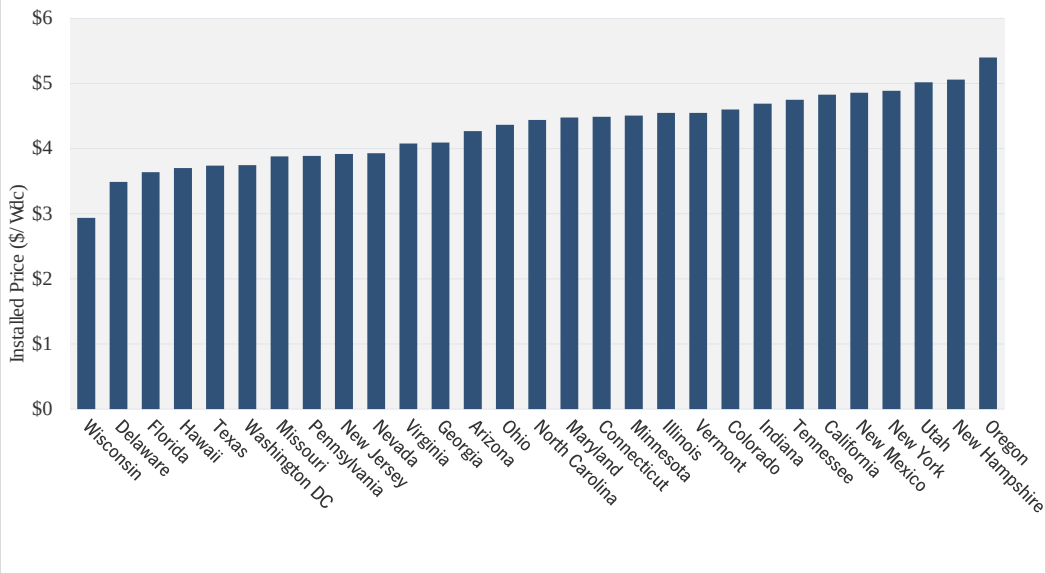


Figure 2.47 Average Non-Residential Installed Price by State, Q4 2013

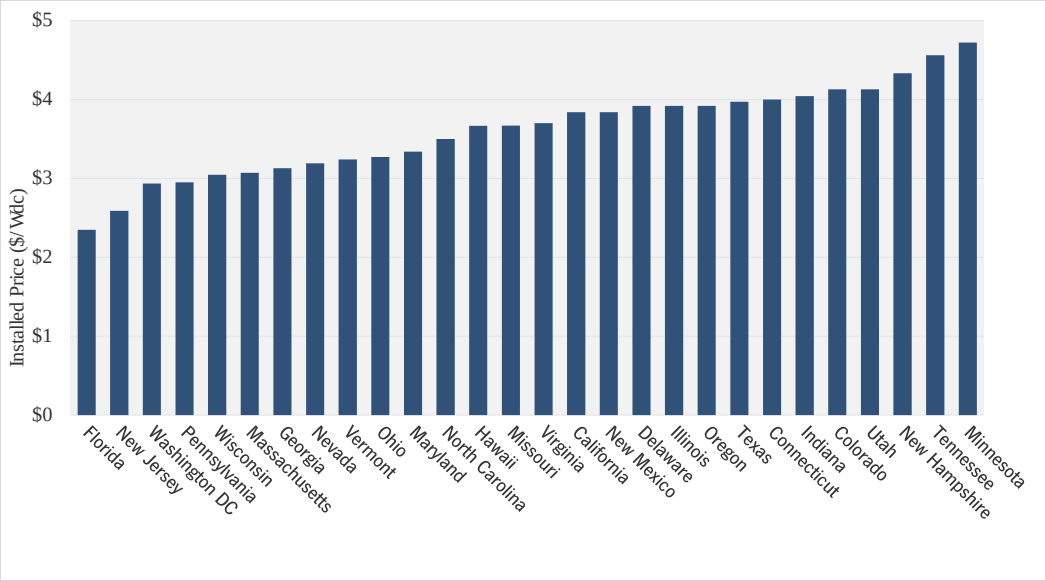
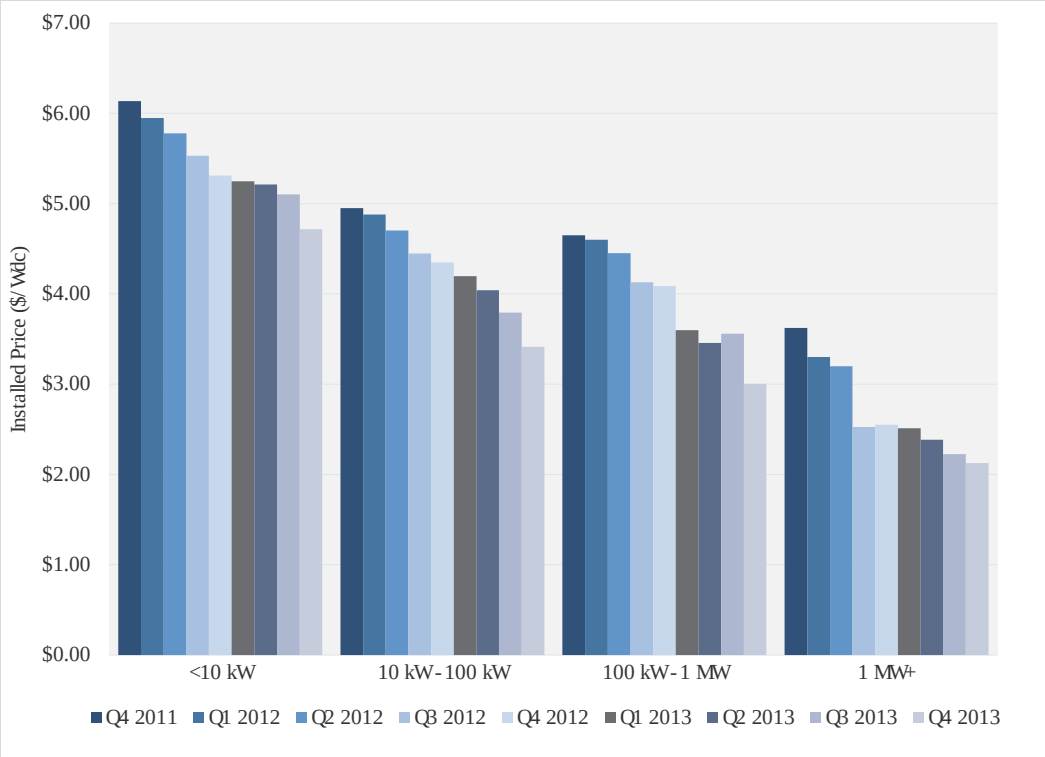


Figure 2.48 National Capacity-Weighted Average System Prices, Q4 2011-Q4 2013



2.5. Manufacturing

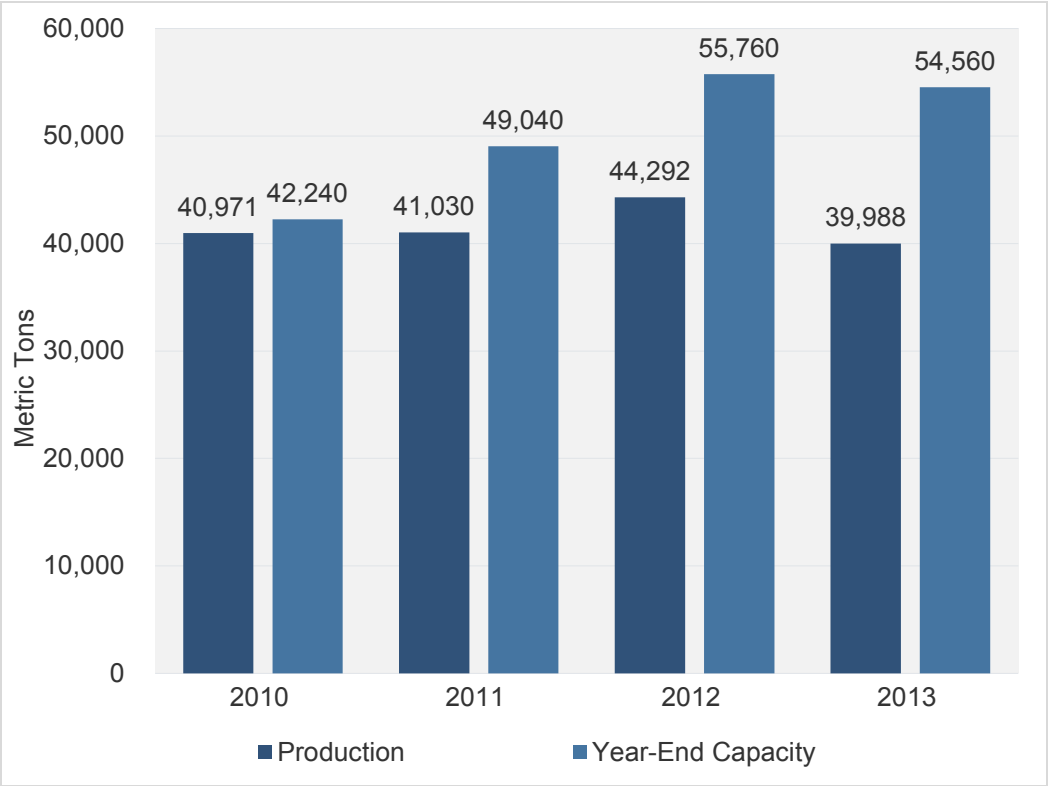
After two years of overcapacity-induced price declines and heavy financial losses, 2013 marked a turnaround for the global solar manufacturing sector, as strong end-market growth combined with a more consolidated supply landscape to restore balance between supply and demand. Market conditions improved gradually over the course of the year, with production volumes and pricing levels notably higher in the second half of the year compared to the first. The best-positioned U.S. suppliers, particularly downstream-integrated firms, enjoyed healthy profits and sales growth in 2H 2013, and 2014 promises to be the most profitable and stable year for PV manufacturing since the heady days of 2010. However, U.S. solar manufacturing growth in 2013 still lagged behind the rest of the world, as many pure-play solar component manufacturers in the U.S. continued to struggle in 2013 due to continuing competition from lower-cost suppliers and a lack of business model differentiation and geographic diversification. Consequently, 2013 also witnessed some notable historical producers such as REC, SolarWorld and Sharp announce layoffs and plant shutdowns, a reminder that consolidation in the manufacturing landscape will still continue despite improving business conditions and overall market growth.

2.5.1. Polysilicon

U.S. polysilicon production for the solar market in 2013 was estimated at 39,988 metric tons (MT), which was a decrease of 10% compared to 2012. This decline is predominantly due to two factors: the stoppage of production at REC's 2,500 MT Siemens-based Polysilicon 1 plant in

Washington in January 2013, and the imposition of severe antidumping tariffs on imports of U.S. polysilicon into China in July 2013. Taken together, tariffs against U.S. suppliers such as REC, Hemlock and SunEdison ranged from 53% to 60%. Since China represents about 85% of the global demand for solar polysilicon, the ruling had a notable negative impact on U.S. polysilicon firms, particularly REC and Hemlock, whose shipments to China were reduced significantly in 2H 2013. However, the impact of the tariff has been greatly mitigated by the fact that it does not apply to imports of silicon used for production of exported modules, and this loophole has allowed U.S. firms to continue to supply large volumes of polysilicon to Chinese ingot and wafer manufacturers – REC still estimated its market share in China to be 18% in Q4 2013. Total U.S. capacity for solar-grade polysilicon stood at 54,560 MT at the end of 2013, nearly flat compared to 2012, and an increase of 29% since 2010.

Figure 2.49 U.S. Solar-Grade Polysilicon Production and Year-End Capacity, 2010-2013



Polysilicon (Metric Tons)	2010	2011	2012	2013
Year-End Manufacturing Capacity	42,240	49,040	55,760	54,560
Annual Production	40,971	41,030	44,292	39,988

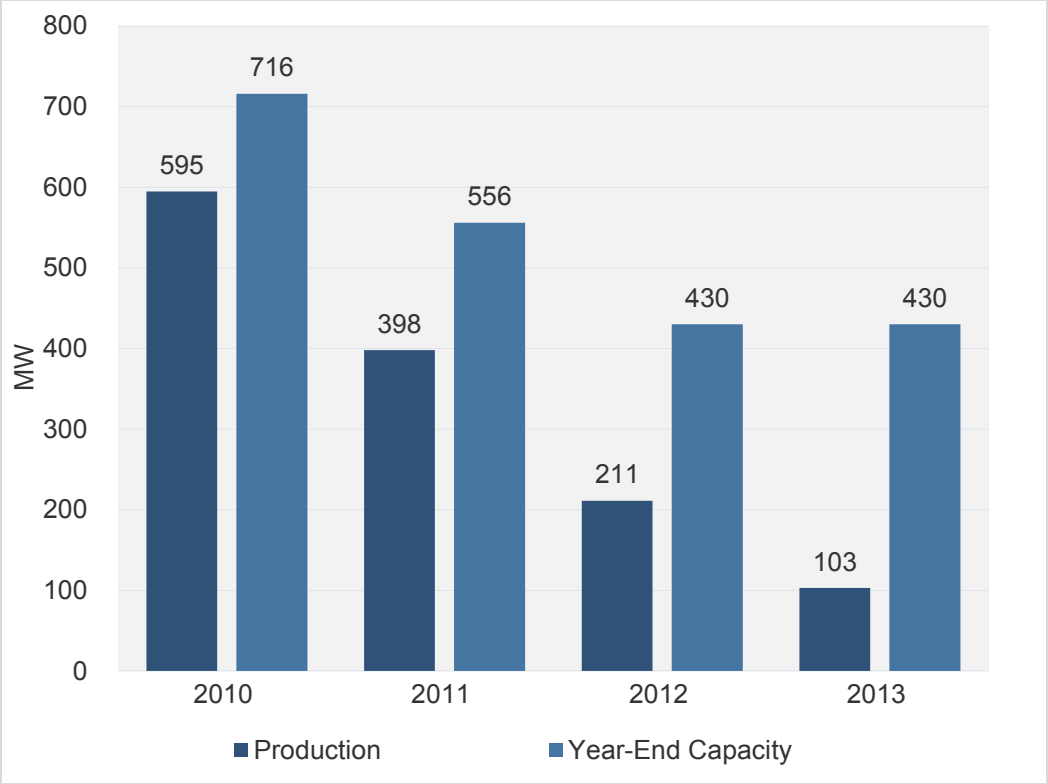
Figure 2.50 U.S. Solar-Grade Polysilicon Quarterly Capacity and Production, Q4 2012-Q4 2013

Polysilicon (Metric Tons)	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Quarterly Capacity	13,940	13,865	13,790	13,715	13,640
Quarterly Production	11,491	10,113	9,157	10,109	10,609

2.5.2. Wafer

U.S. solar wafer production was estimated to be 103 MW in 2013, down by 51% from 2012's total of 211 MW. Year-end capacity stood at 430 MW, which was flat compared to 2012, but the top-level number belies the reality that very little of this capacity is currently active and being utilized for commercial production. Presently, there remains only one active wafer manufacturing facility in the U.S. (SunEdison in Oregon), which is operating well below its nameplate capacity of 180 MW, and SolarWorld announced that it would cease producing ingots and wafers out of its 250 MW Oregon facility for the foreseeable future.

Figure 2.51 U.S. Solar Wafer Production and Year-End Capacity, 2010-2013



Wafer (MW)	2010	2011	2012	2013
Year-End Manufacturing Capacity	716	556	430	430
Annual Production	595	398	211	103

Figure 2.52 U.S. Solar Wafer Quarterly Capacity and Production, Q4 2012-Q4 2013

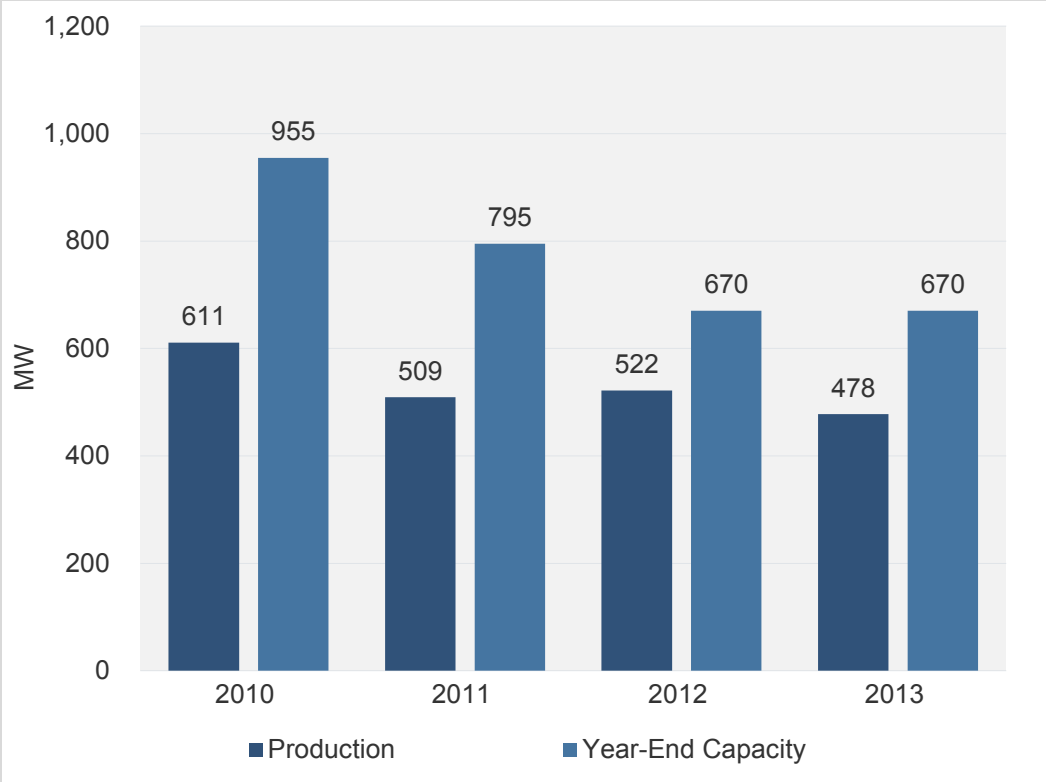
Wafer (MW)	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Quarterly Capacity	108	108	108	108	108
Production	19	38	38	11	16

2.5.3. Cell

Note: Thin film facilities producing modules through monolithic integration are not defined as producing cells in this report series.

U.S. crystalline silicon cell production was estimated at 478 MW in 2013, a drop of 8% over 2012. To a large extent, this was due to reduced output from SolarWorld in the first half of 2013, a result of its financial restructuring. Year-end cell capacity remained flat at 670 MW, made up almost entirely by SolarWorld in Oregon and Suniva in Georgia.

Figure 2.53 U.S. Crystalline Silicon Cell Production and Year-End Capacity, 2010-2013



Crystalline Silicon Cell (MW)	2010	2011	2012	2013
Year-End Manufacturing Capacity	955	795	670	670
Annual Production	611	509	522	478

Figure 2.54 U.S. Crystalline Silicon Cell Quarterly Capacity and Production, Q4 2012-Q4 2013

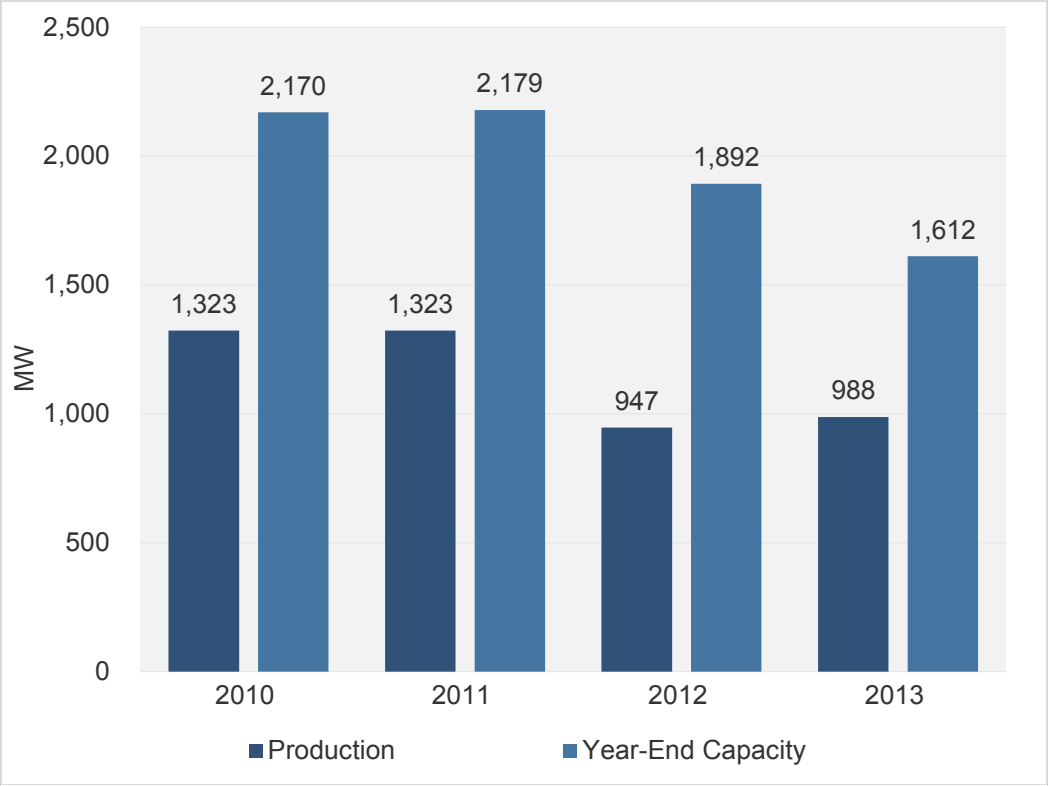
Crystalline Silicon Cell (MW)	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Quarterly Capacity	175	168	168	168	168
Production	124	103	117	126	132

2.5.4. Module

U.S. PV module production in 2013 was estimated at 988 MW, an increase of 4% over 2012. Underscoring the improvement in market conditions over the past year, Q4 2013 production of 270 MW was 56% higher than production volumes for the same period in 2012. However, the top-line growth figures mask an uneven picture at the firm-specific level. While well-positioned, downstream-integrated manufacturers enjoyed significant production growth, this was offset by continuing difficulties for smaller, higher-cost, pure-play component firms, which continued to struggle even amidst stabilizing prices. Notable cases of insolvency or plant shutdowns amongst U.S. module producers included Advanced Solar Photonics (Florida), Helios USA

(Wisconsin), MX Solar (New Jersey), Nanosolar (California) and Suntech Power (Arizona). Year-end U.S. module capacity in 2013 stood at 1,612 MW, down 15% from 2012 and 26% from 2011's all-time high of 2,179 MW.

Figure 2.55 U.S. PV Module Production and Year-End Capacity, 2010-2013



Module (MW)	2010	2011	2012	2013
Year-End Manufacturing Capacity	2,170	2,179	1,892	1,612
Annual Production	1,323	1,323	947	988

Figure 2.56 U.S. PV Module Quarterly Capacity and Production, Q4 2012-Q4 2013

Module (MW)	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Quarterly Capacity	465	450	433	408	405
Quarterly Production	173	208	247	263	270

In terms of technology, U.S. thin-film module production in 2013 was 372 MW, compared to 616 MW for crystalline silicon (c-Si). This gave thin-film PV a production share of 38% in the U.S., significantly higher than the global average of about 12%. Thin film production share was markedly higher than 2012's estimate of 29%, with the bulk of production coming from First Solar's 320 MW CdTe facility in Ohio and MiaSolé's 150 MW CIGS plant in California.

Figure 2.57 U.S. Module Production by Technology, 2010-2013

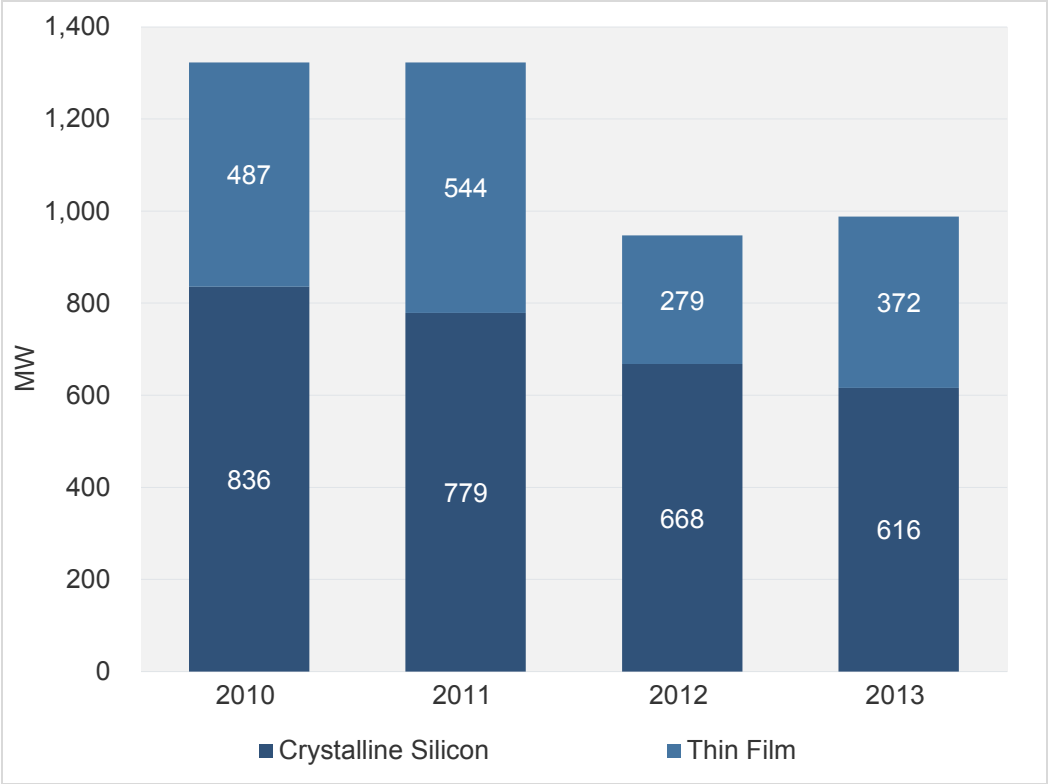


Figure 2.58 U.S. Module Production by Technology, Q1 2013-Q4 2013

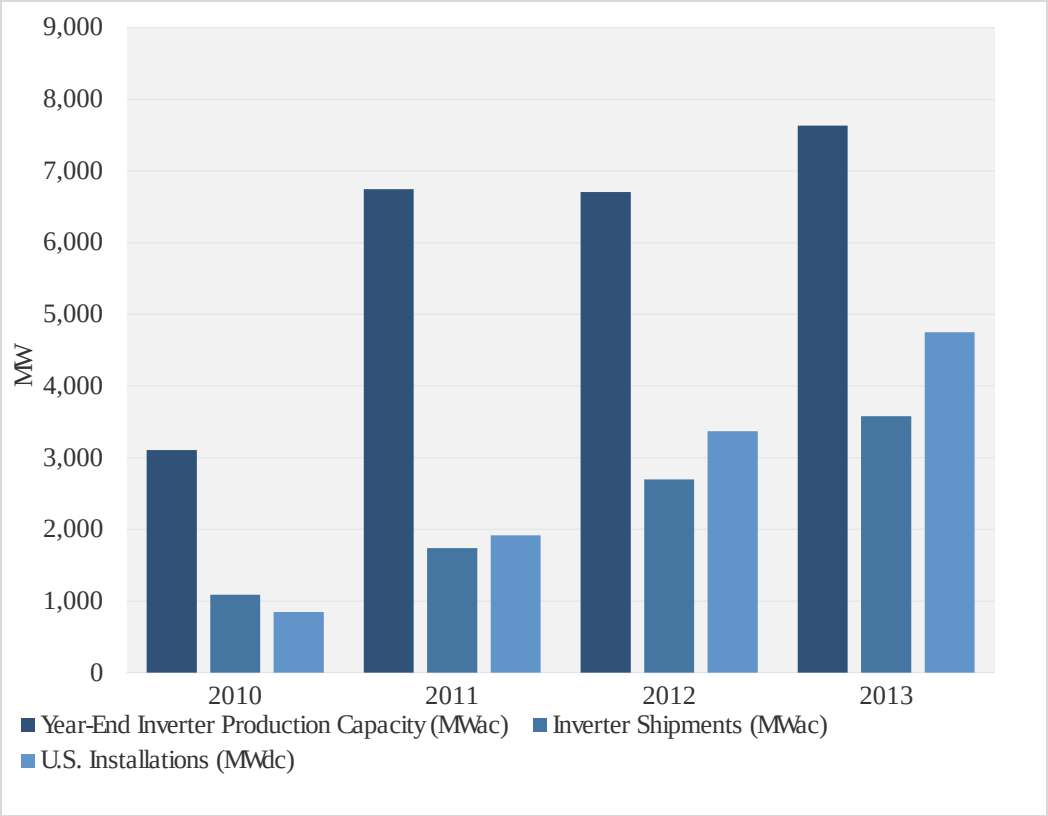
Module (MWp)	Q1 2013		Q2 2013		Q3 2013		Q4 2013	
	Capacity	Production	Capacity	Production	Capacity	Production	Capacity	Production
Crystalline Si	265	128	254	152	236	166	237	171
CdTe	73	58	75	64	78	70	80	72
CIGS	101	21	94	29	88	26	82	26
Thin-Film Si	6	1	6	1	6	1	6	1
Total	450	208	433	247	408	263	405	270

2.5.5. Inverters

2013 marked another earth-shattering year for the global inverter landscape, with top players engaging in market-moving mergers and acquisitions and regional shifts crowning Asian manufacturers as market leaders. Although the U.S. has been a major target for European entrants, the major players in the U.S. have changed only slightly. Domestic manufacturing continues to supply a dominant portion of the market, although the overall share of domestic

manufacturers in the market has eroded somewhat in the past year. Shipments of PV inverters grew by 33% in 2013, increasing from 2.7 GWac to nearly 3.6 GWac as the boom in the utility sector continues to support major U.S. manufacturers. Capacity has also expanded over the course of the year, rising from 6.7 GWac at the end of 2012 to 7.6 GWac at the end of 2013. This growth was characterized more by expansion of existing facilities rather than the entry of any new manufacturers to the market.

Figure 2.59 Annual Inverter Capacity and Production (MWac) vs. Installations (MWdc), 2010-2013



	2010	2011	2012	2013
Year-End Inverter Production Capacity (MWac)	3,108	6,747	6,706	7,632
Inverter Shipments (MWac)	1,087	1,737	2,699	3,577
U.S. Installations (MWdc)	849	1,915	3,369	4,751

As with other years, seasonality played a huge factor in boosting year-end totals, with 38%, or 1.4 GWac, of shipments coming in in the last quarter. Note that we have revised estimates for Q3 2013 up due to a higher-than-expected level of utility connections in the early part of Q4 2013.

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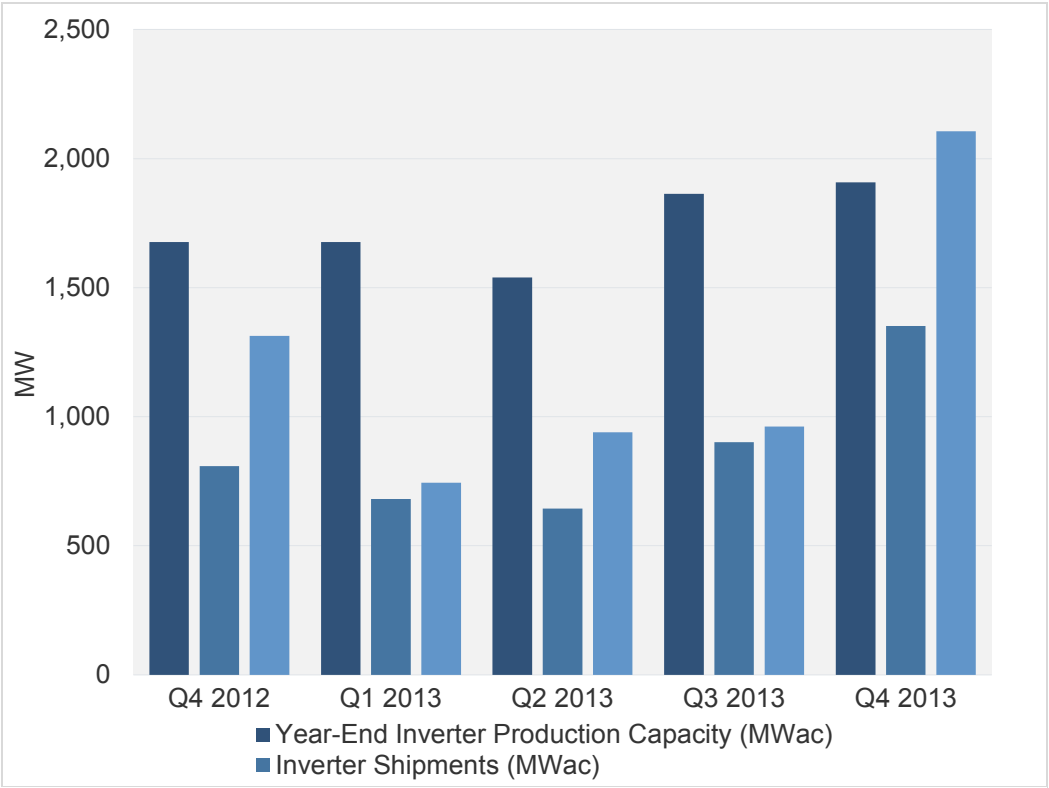
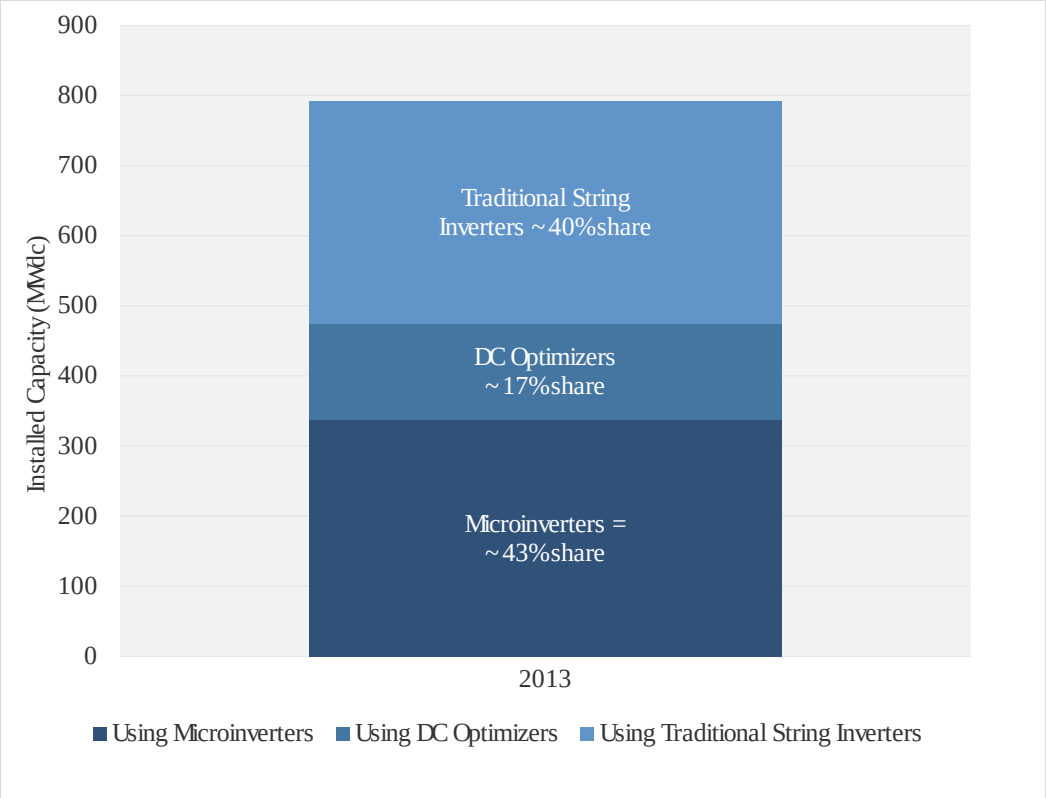
Figure 2.60 Quarterly Domestic Inverter Capacity and Production (MWac) vs. Installations (MWdc)



	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Inverter Production Capacity (MWac)	1,677	1,677	1,539	1,864	1,908
Inverter Shipments (MWac)	808	681	644	901	1,351
U.S. Installations (MWdc)	1,313	744	939	962	2,106

Much of the support for domestic manufacturing has been solidly rooted in the commercial and utility market segments, where bankability and field experience strongly favor U.S. brands operating in the space. While non-domestic inverter manufacturers are beginning to win significant projects in the U.S., we continue to expect that this landscape will strongly favor domestic manufacturing, especially as significant European players have more established U.S. manufacturing facilities in place. In the U.S. residential sector, the opposite is occurring. The popularity of microinverters and DC optimization-based systems has led to significant penetration by companies with foreign manufacturing (note that while Enphase is a U.S.-headquartered company, it manufactures through a partnership with Flextronics, predominantly in Asia). In fact, module-level power electronics are estimated to account for over half of U.S. residential installations, with microinverters grabbing over 42% market share. This means that traditional non-DC optimizer-based string inverters actually represent a minority in the market.

Figure 2.61 2013 Residential Installed Capacity by Inverter Type



U.S. Residential Installed Capacity (MWdc)	2013
Microinverters	338
DC Optimizers	137
Traditional String Inverters	317
Total	792

2.6. Component Pricing

2.6.1. Polysilicon, Wafers, Cells and Modules

After two years of continuous and often precipitous declines, pricing for polysilicon and upstream PV components recovered in 2013 due to a much stronger global supply-demand balance. Pricing for polysilicon, wafers and modules in Q4 2013 registered increases of low single digits compared to Q4 2012, while Q4 2013 cell pricing was up 35% year-over-year. This was due to price hikes for Taiwanese cells driven by explosive growth in the Japanese end market, where large volumes of Taiwanese cells are currently sold for module assembly. On a quarterly basis, pricing continued to tick upwards slightly compared to Q3 2013 due to strong end demand in Japan, the U.S. and China, as well as a more consolidated supply chain. Blended polysilicon

prices increased by 6% quarter-over-quarter to $20.2/kg, while blended module ASPs were up to $0.72/W, 3% higher than Q3 2013 levels. Pricing increases are set to continue over the course of 2014, with spot polysilicon currently trading in the $24 to $25/kg range and U.S. module pricing increasing by 1 to 2 cents/W in January and February.

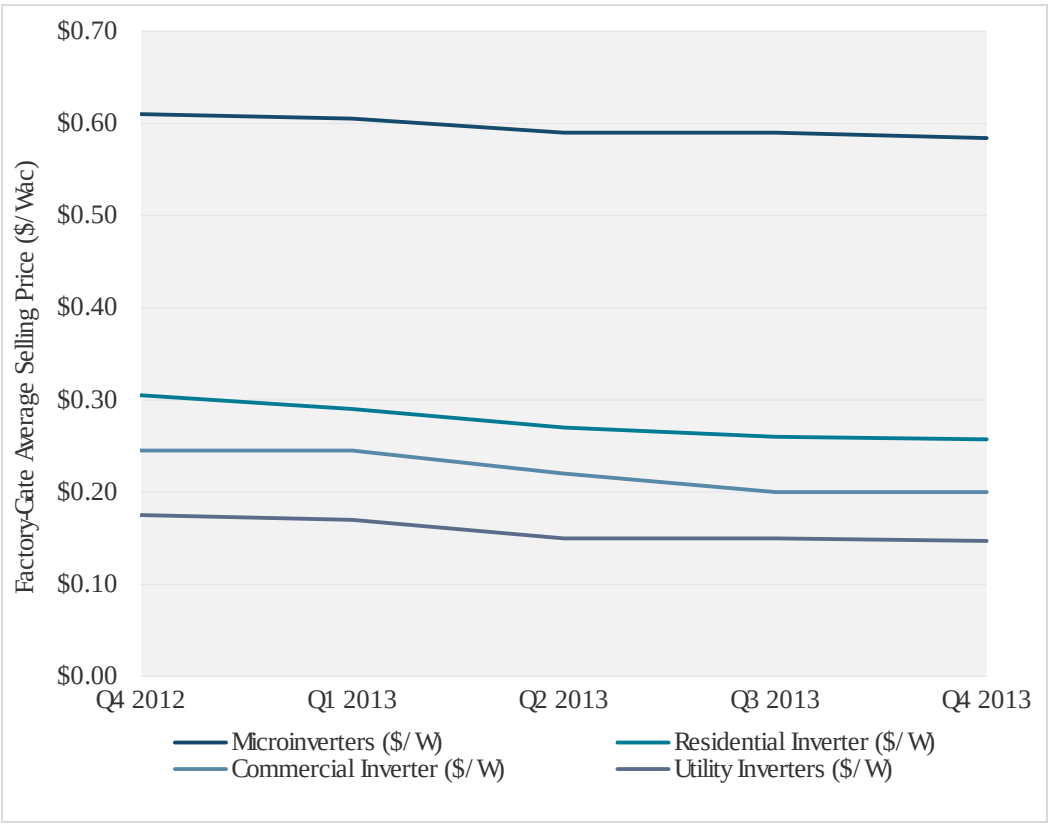
Figure 2.62 U.S. Polysilicon, Wafer, Cell, and Module Prices, Q4 2012-Q4 2013

	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Polysilicon ($/kg)	$19.88	$17.36	$19.00	$19.00	$20.20
Wafer ($/W)	$0.23	$0.21	$0.22	$0.22	$0.23
Cell ($/W)	$0.31	$0.32	$0.44	$0.42	$0.43
Module ($/W)	$0.68	$0.64	$0.68	$0.70	$0.72

2.6.2. Inverters

Factory-gate pricing remained relatively steady in the U.S. despite small declines in Q4 2013. This was the result of relatively strong demand in Q3 and Q4, particularly in the large commercial and utility market segments, as well as significant price reductions already undertaken by major market share leaders. Nevertheless, the U.S. remains a relatively high-priced market for inverters in the global context, and interest from European and Asian competitors continues to pour into the market, especially in the central inverter category. Many of these relatively new entrants have already exhibited significant steps toward gaining greater market traction.

Figure 2.63 Factory-Gate PV inverter Pricing, Q4 2012-Q4 2013



National Average Pricing	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Microinverters ($/W)	$0.61	$0.61	$0.59	$0.59	$0.58
Residential Inverters ($/W)	$0.31	$0.29	$0.27	$0.26	$0.26
Commercial Inverters ($/W)	$0.25	$0.25	$0.22	$0.20	$0.20
Utility Inverters ($/W)	$0.18	$0.17	$0.15	$0.15	$0.15

2.6.3. Mounting Structure Prices

SolarCity's acquisition of Zep Solar in Q4 2013 became the big story of the U.S. mounting structure market and was seen as a boon by residential mounting structure competitors, potentially causing customers of Zep Solar and competitors to SolarCity to turn back to the open market for their racking hardware. However, pricing continued to fall in the market in Q4 2013. Overall, we have seen a 24% price reduction in residential mounting hardware since last year.

Other markets continue to be challenged, with commercial rooftop and ground-mount hardware prices falling roughly 20% year-over-year, as well. Low-end pricing in commercial rooftop systems continues to challenge typically higher incumbent pricing. In contrast, ground-mount

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hardware looks to have somewhat stabilized in the past couple of quarters, likely due to large margin compression early in the year.

We continue to note that factory-gate pricing for PV mounting structures differs heavily depending on market segment, geography, configuration, layout and project size, all of which complicate the calculation of an "average" cost. For example, manufacturers reported costs in the fourth quarter for commercial rooftop systems of anywhere between $0.16/W to $0.24/W. For simplicity, we note that the values reported below reflect the mounting-structure-only costs of the following system types:

- **Residential rooftop**: 5 kW to 10 kW sloped roof in California using a clamp-and-rail-based system and waterproofed penetration mounts
- **Commercial rooftop**: 100 kW to 500 kW flat-roof ballasted system in low wind areas requiring no additional structural support
- **Ground-mount fixed-tilt**: 1 MW to 5 MW fixed-tilt ground-mount system in low wind areas, not including foundation structures

Even with these baselines, note that PV mounting structure purchasers should consider the full implied cost of individual manufacturers rather than relying on quotes versus the national average. Differences in racking materials and design have different implications for labor costs, grounding requirements and the need for additional structural support. It should also be noted that we have revised our historical pricing in previous quarters given significant feedback that our values represented higher than market values.

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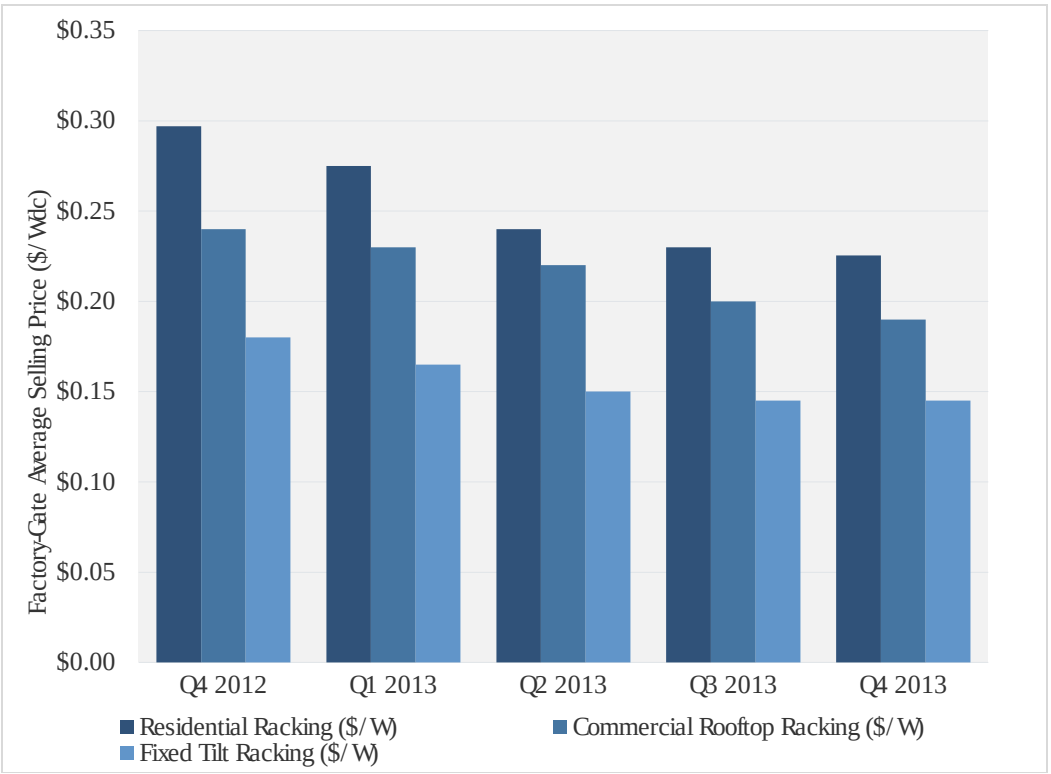
Figure 2.64 PV Mounting Structure Prices, Q4 2012-Q4 2013



Average Price (National Aggregate)	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013
Residential Racking ($/W)	$0.30	$0.28	$0.24	$0.23	$0.23
Commercial Rooftop Racking ($/W)	$0.24	$0.23	$0.22	$0.20	$0.19
Fixed Tilt Racking ($/W)	$0.18	$0.17	$0.15	$0.15	$0.15

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3. Concentrating Solar Power

3.1. Introduction

In the U.S., concentrating solar thermal power plants, experienced a burst of project activity in California in the 1980s and then went dormant for two decades. But in the last few years, there has been an uptick of activity in this space, with an extensive list of CSP projects planned across the country. However, concentrating solar has not been immune to the turmoil of the larger solar industry, and the past few quarters have seen a number of CSP projects shelved or delayed.

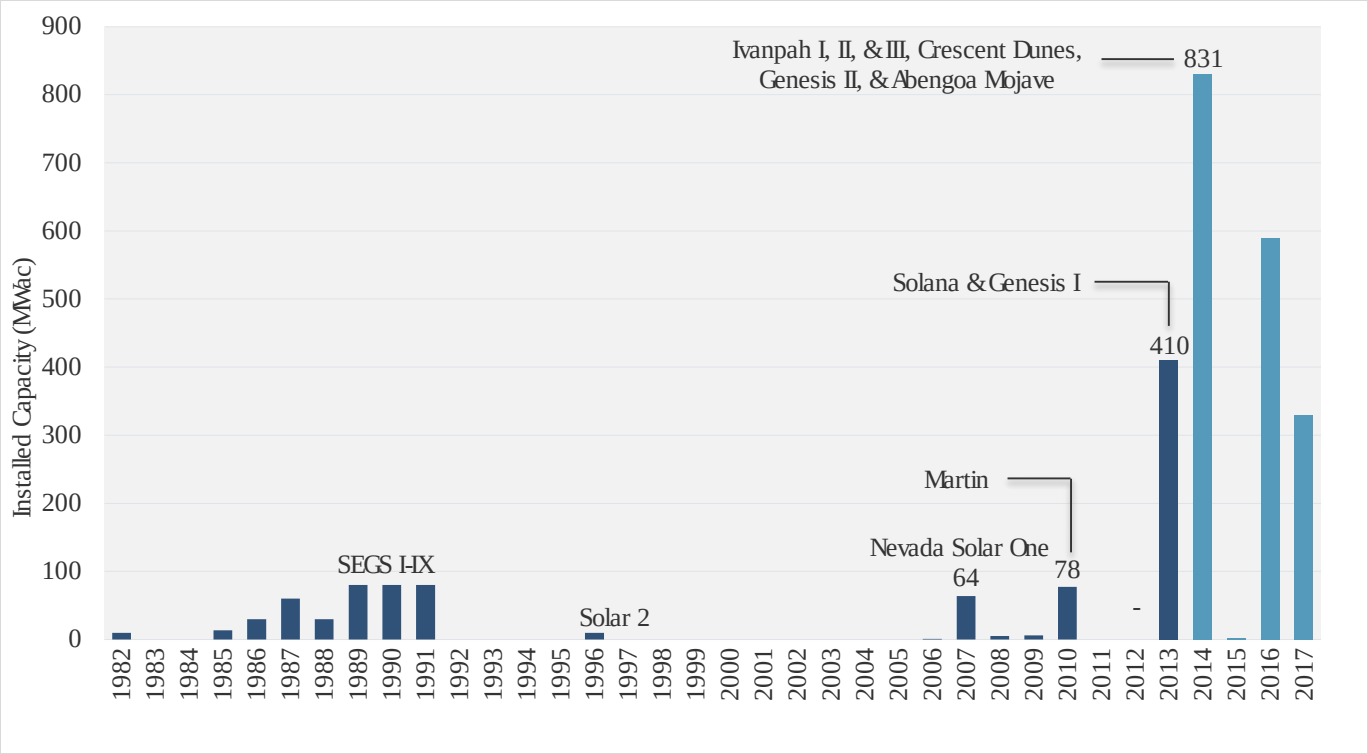
3.2. Installations

Figure 3.1 Concentrating Solar Installations, 2010-Q4 2013

Capacity Installed by State (MWac)	2010 Total	2011 Total	2012 Total	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Cumulative
Arizona	2	-	-	-	-	-	280	283
California	-	-	-	-	-	-	125	489
Florida	75	-	-	-	-	-	-	75
Hawaii	-	-	-	5	-	-	-	7
Nevada	-	-	-	-	-	-	-	64
Total	77	-	-	5	-	-	405	918

3.3. Installation Forecast

Figure 3.2 CSP Installation Forecast, 1982-2017E



As shown in Figure 3.2, the concentrating solar industry in the U.S. was effectively dormant from 1992 to 2006. In 2007, there was one project of scale: a 64 MWac trough plant in Nevada. The last five years have seen the construction of several small demonstration plants for various technologies, including a 5 MWac compact linear Fresnel reflector (CLFR) plant in California in 2008, a 5 MWac tower plant in California in 2009, and a 1 MWac micro-CSP plant in Hawaii in 2009. The 75 MWac FP&L Martin Solar plant in Indiantown, Florida came on-line in the fourth quarter of 2010.

While the 5 MWac Kalaeloa Solar One project was the only concentrating solar power (CSP) project to come on-line during the first three quarters of 2013, in Q4 the first wave of mega-scale CSP projects began to come on-line, starting with Abengoa's 280 MWac Solana Generating Station and the first 125 MWac phase of NextEra's Genesis solar project.

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Figure 3.3 Select Concentrating Solar Project Development Highlights

Project	Developer	State	Capacity (MWac)	Expected Completion	Project Status Update
Ivanpah	BrightSource Energy	CA	392	2014	Achieved full commercial operation in February 2014
Crescent Dunes	SolarReserve	NV	110	2014	SolarReserve delayed completion from December 2013 to early 2014; commissioning began in February 2014
Mojave Solar	Abengoa	CA	250	2014	Abengoa awarded Wood Group GTS with contract to install two steam turbines for the project
Tooele Army Depot Solar	Army Corps of Engineers	UT	1.5	2014	Cycle engine manufacturer Infinia filed for bankruptcy, but will operate under limited capacity to supply its PowerDish arrays
Palen Solar	BrightSource Energy, Abengoa Solar	CA	200	2016	The California Energy Commission released a proposed decision to reject conversion to solar power tower technology
Quartzsite Solar Project	SolarReserve	AZ	100	2017	SolarReserve delayed Quartzsite Solar Project's expected date of completion until 2017
Saguache	SolarReserve	CO	200	2017	SolarReserve delayed Saguache’s expected date of completion until 2017
Sonoran West	BrightSource Energy	CA	540	2017	BrightSource increased Sonoran West's capacity to 540 MWac

GTM Research maintains a database tracking the progress of all planned CSP projects in the U.S. The pipeline currently contains over 1,751 MWac of CSP projects with signed PPAs, as well as another 1,610 MWac of projects under development that have not yet signed PPAs with utilities.

These concentrating solar power projects are expected to be completed between 2014 and 2017, and 2014 is expected to exceed last year’s installation totals with the completion of Ivanpah and commenced commissioning of Crescent Dunes. Both of these projects were initially expected to partially or fully come on-line in 2013, but large-scale CSP projects have proven to require extended commissioning schedules that can last months. Ivanpah, for example, underwent initial sync testing in September 2013, ramped up operations in early January 2014, and then curtailed power until it achieved commercial operation in February

2014. These commission schedules are important considerations we factor into the expected completion dates of projects over the next three years.

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After 2014, it is unclear whether issues with financing, approvals, and development will affect the timelines of the current pipeline. We continue to be cautious in our forecast of CSP growth. Declines in PV module costs have undercut trough technology and put it at a significant cost disadvantage. Since the beginning of 2013, 1 GWac of CSP projects has been suspended, and an additional 305 MWac have been delayed. Separate from Crescent Dunes, SolarReserve delayed the commission date of both the Quartzsite Solar Project and the Saguache project. AREVA has also pushed back the expected date of completion for its Sundt Solar Boost Project in Arizona.

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Appendix A: Metrics and Conversions

Photovoltaics

We report PV capacity data in watts of direct current (DC) under standard test conditions (STC). This is the metric most commonly used by suppliers, developers and program administrators. However, some program administrators report data in alternating current (AC) watts, and some utility-scale systems are measured in AC watts. In these cases, we assume an 87% DC-to-AC derate factor based on data from existing systems, conversations with installers, and averages from California Solar Initiative data.

Concentrating Solar Power

We report CSP capacity data in watts of alternating current (AC), which is the metric most commonly used in the CSP industry. As a result, capacity comparisons for CSP and PV should not be considered on an apples-to-apples basis.

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Appendix B: Methodology and Data Sources

Please note that data from previous quarters is sometimes updated as a result of improved or changed historical data.

Data for this report comes from a variety of sources and differs by data item, technology, and granularity. Below we outline our methodology and sources.

Historical Installations

PV: Quarterly state-by-state data on PV installations was collected primarily from incentive program administrators. These administrators include state agencies, utility companies, and third-party contractors. For larger projects not included in these programs, GTM Research maintains a database that tracks the status of all operating and planned utility PV projects in the United States. In some cases, program administrators report incentive application and award dates rather than installed dates. In these instances, we use the information that most closely approaches the system's likely installed date. For annual and cumulative installations prior to 2010, 2010 data for "Other States" and smaller utilities, GTM Research also utilized data collected by Larry Sherwood at the Interstate Renewable Energy Council (IREC).

CSP: GTM Research maintains a database that tracks the status of all operating and planned CSP projects in the United States.

PV	State incentive program administrators, utility companies, state public utilities commissions, PUC filings, GTM Research Utility PV Project Database, Larry Sherwood/IREC
CSP	GTM Research CSP Project Database, announcement tracking, state public utilities commissions, conversations with developers/manufacturers

Average System Price

PV: Average system pricing by state was estimated with information from two sources. First, many incentive program administrators track system pricing in addition to capacity data, and this information was collected where possible. GTM Research also conducted a PV installer/integrator survey to determine average system pricing in states where incentive program data was unavailable. These results were checked against known prices for systems within the U.S. Treasury 1603 Grant database and verified through conversations with developers. Average system pricing reflects actual price for installed systems in the respective quarter, not forward pricing for systems to be installed in subsequent quarters.

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PV	GTM Research manufacturing facility databases, announcement monitoring, conversations with manufacturers
CSP	Announcement monitoring, conversations with manufacturers

Manufacturing Production and Component Pricing

GTM Research maintains databases of manufacturing facilities for PV and CSP components.

PV	GTM Research manufacturing facility databases, announcement monitoring, conversations with manufacturers
CSP	Announcement monitoring, conversations with manufacturers

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