

U.S. Solar Market Insight: 2015 Year in Review

State and Future of U.S. Solar

Cory Honeyman

Senior Analyst

honeyman@gtmresearch.com

April 2016

gtmresearch

Contents

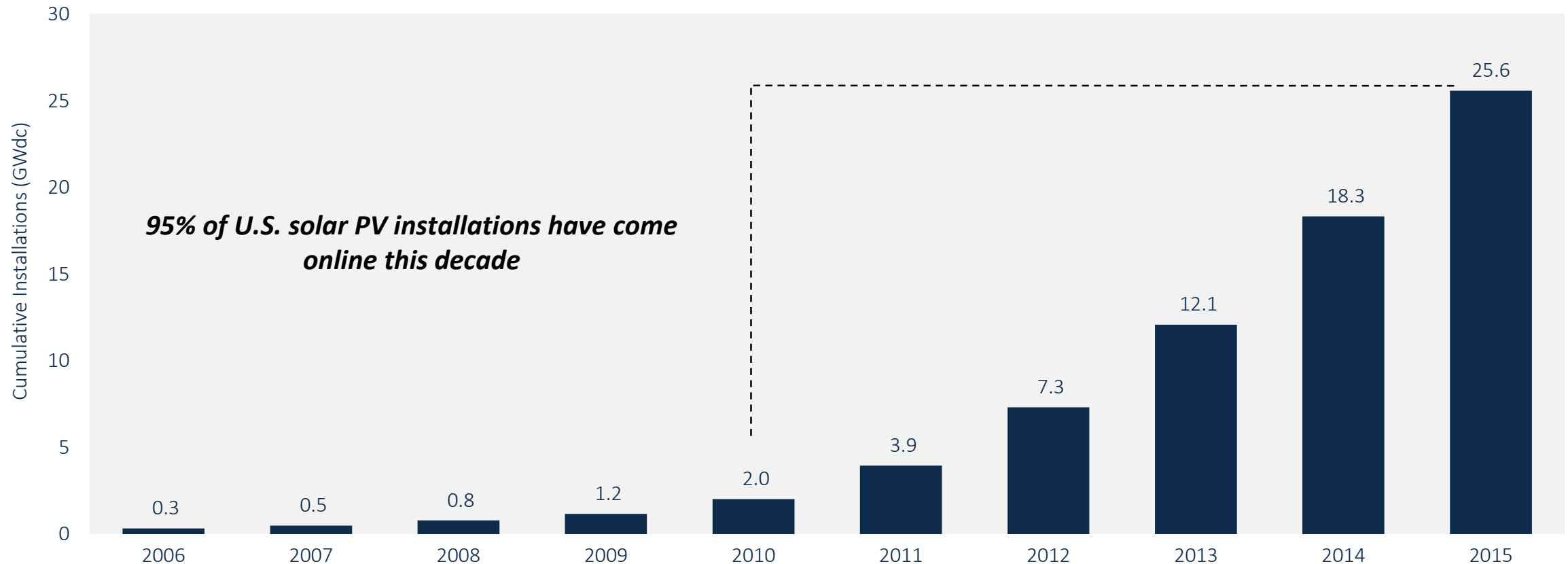
1. U.S. Solar Market to Date: Key Drivers	2
<hr/>	
2. Looking Ahead: Rundown by PV Market Segment	10
<hr/>	
3. Putting It All Together: 4 Predictions for 2016	22
<hr/>	

1. U.S. Solar Market to Date: Key Drivers

Just how much has U.S. solar grown over the past several years?

U.S. Solar: Growing by impressive strides at the national level

Cumulative U.S. Solar PV Installations by Year: 2006-2015

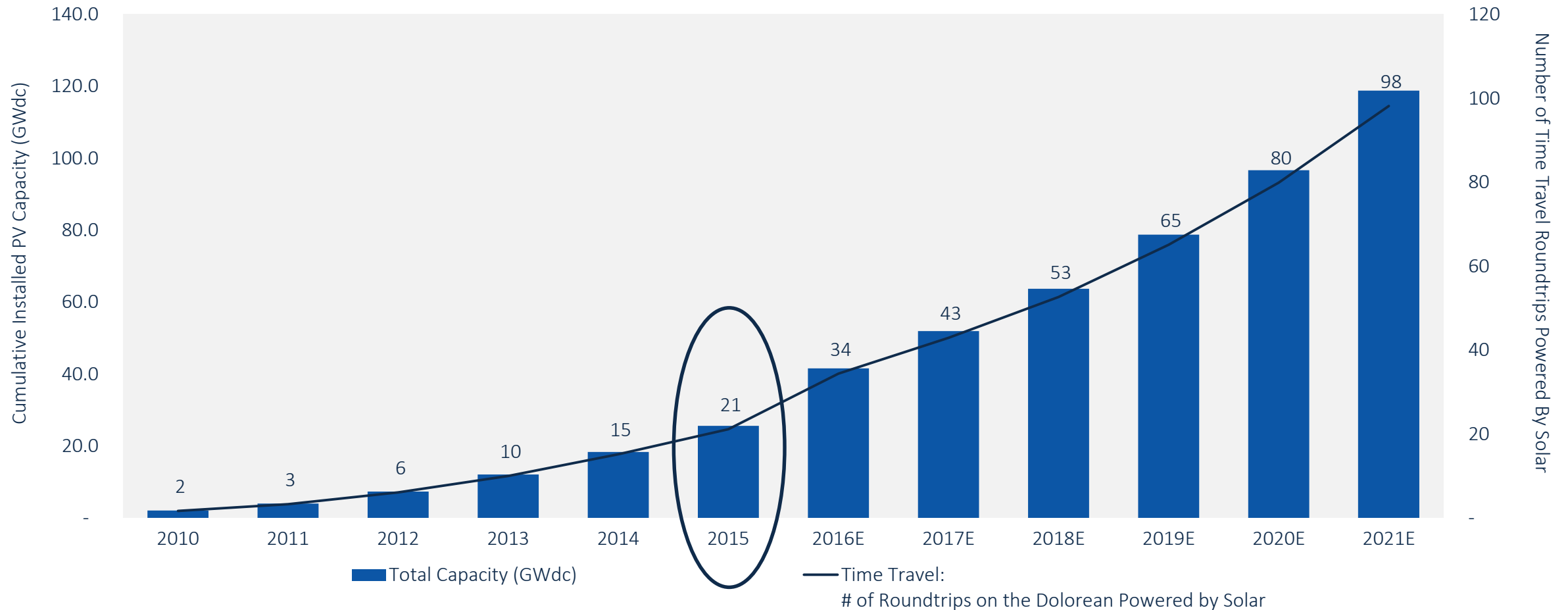


Source: GTM Research/SEIA, U.S. Solar Market Insight

And according to Doctor Emmett Brown from Back to the Future...

If it takes 1.21 gigawatts to perform time travel...

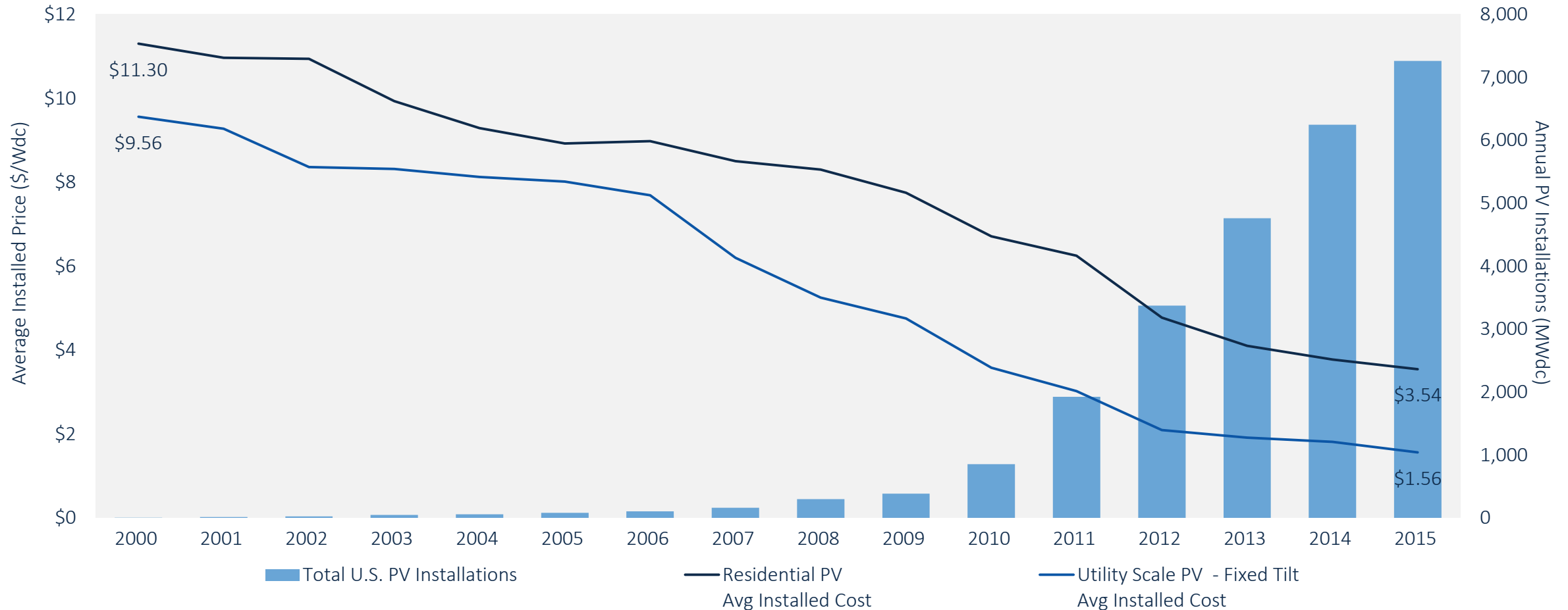
cumulative installed solar PV could currently power MORE THAN 20 trips back and forth into the future.



Source: Doctor Emmett Brown and GTM Research

In large part, U.S. PV growth stems from meaningful cost reductions across all segments

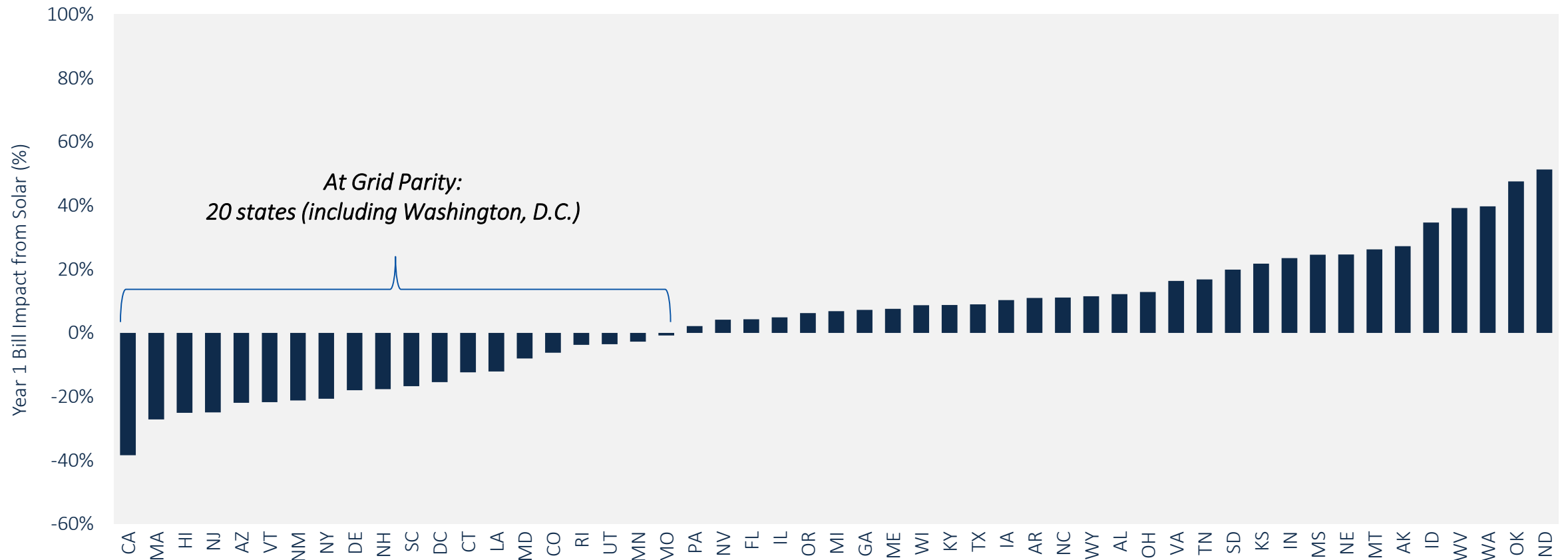
Average Installed Cost by Segment vs. Total U.S. PV Installations: 2000-2015



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

Leading to more and more states (especially for residential solar) reaching grid parity

Number of States at Grid Parity in 2016

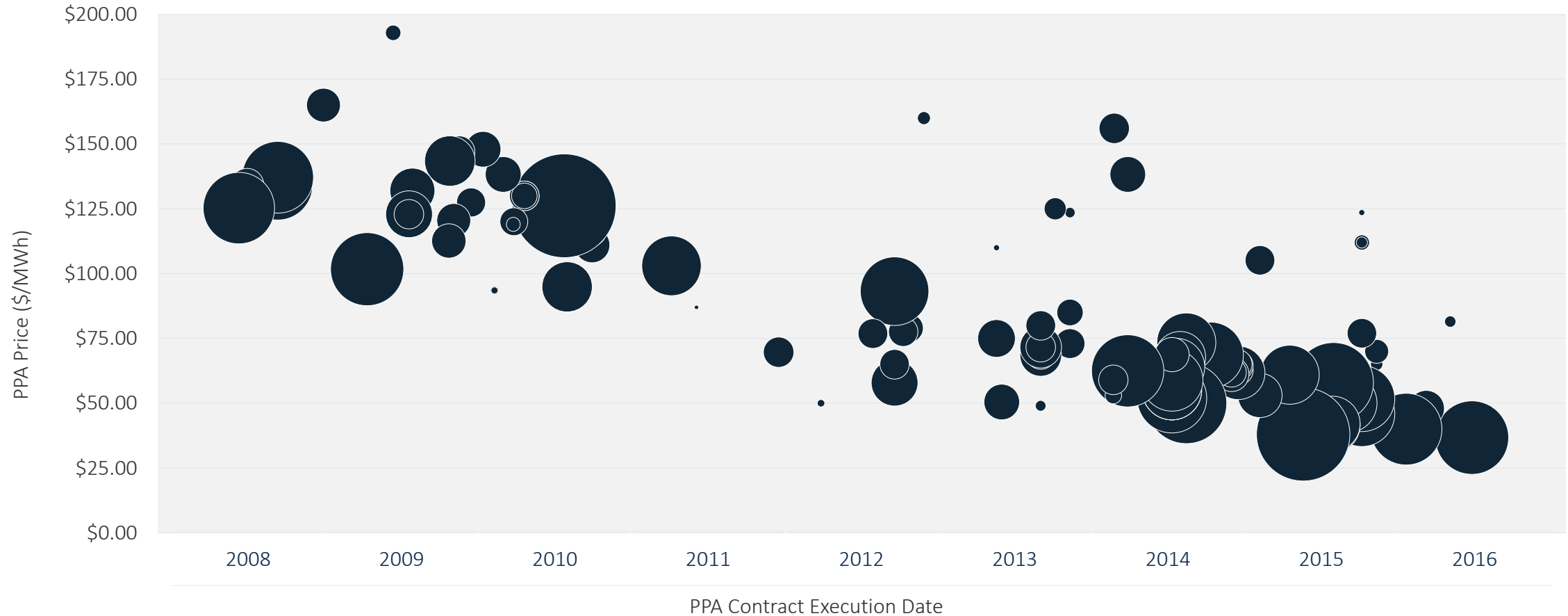


Note: Grid parity metrics account for all NEM and rate reforms currently in effect for modeled utilities.

Source: GTM Research, U.S. Residential Solar Economic Outlook

And a 20 GW+ pipeline of utility scale projects increasingly driven by cost competitiveness

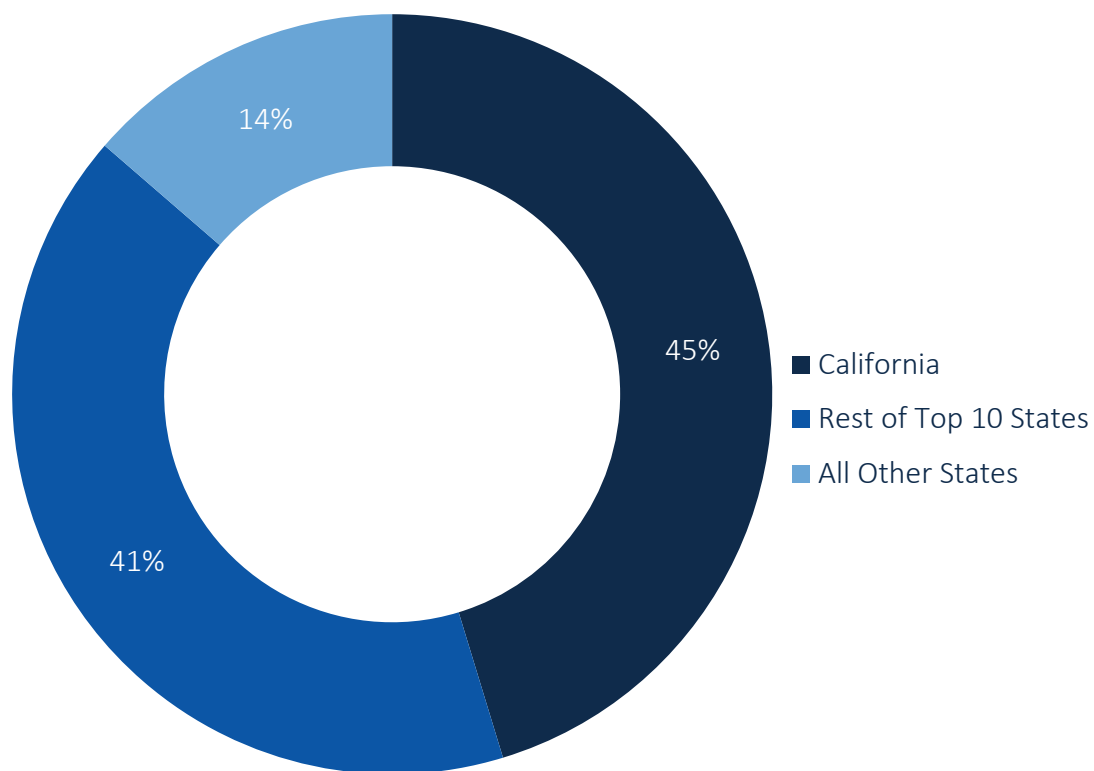
Utility PV PPA Prices by Contract Execution Date



Source: U.S. Utility PV Market Tracker

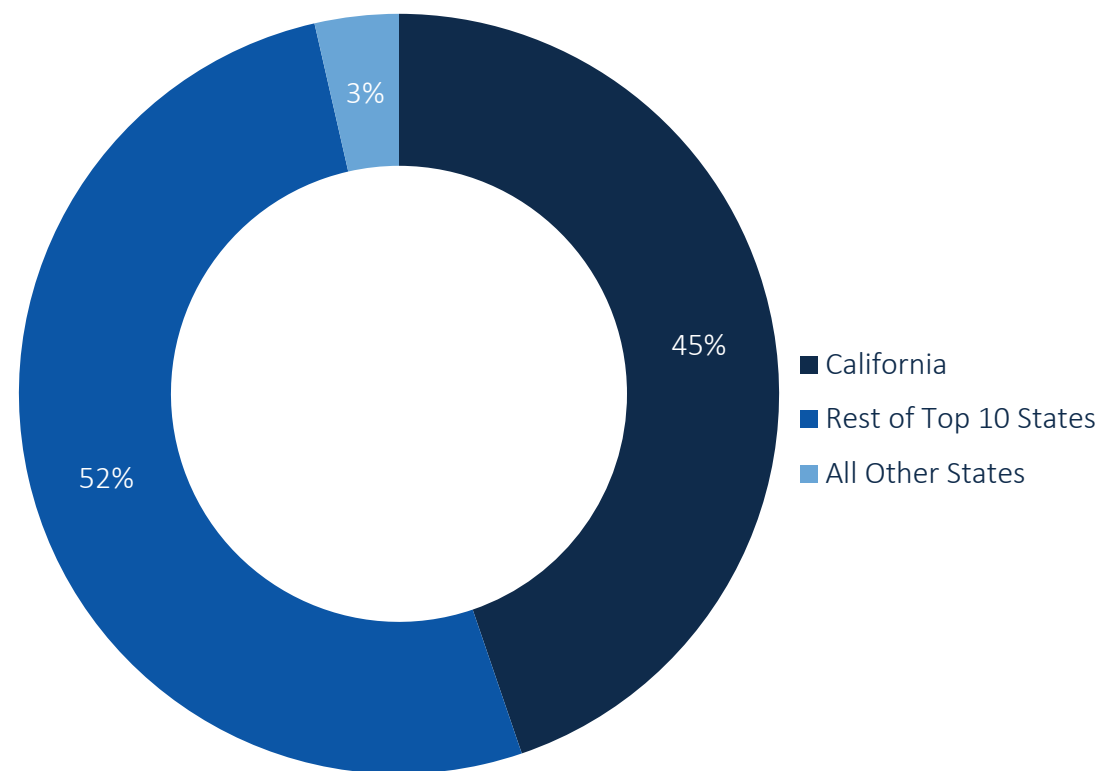
Despite growing levels of cost competitiveness... 80%+ of 2015 demand came from the top 10 states in each market segment

Distributed PV Installations:
California vs. Rest of Top 10 States vs. Rest of U.S.



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

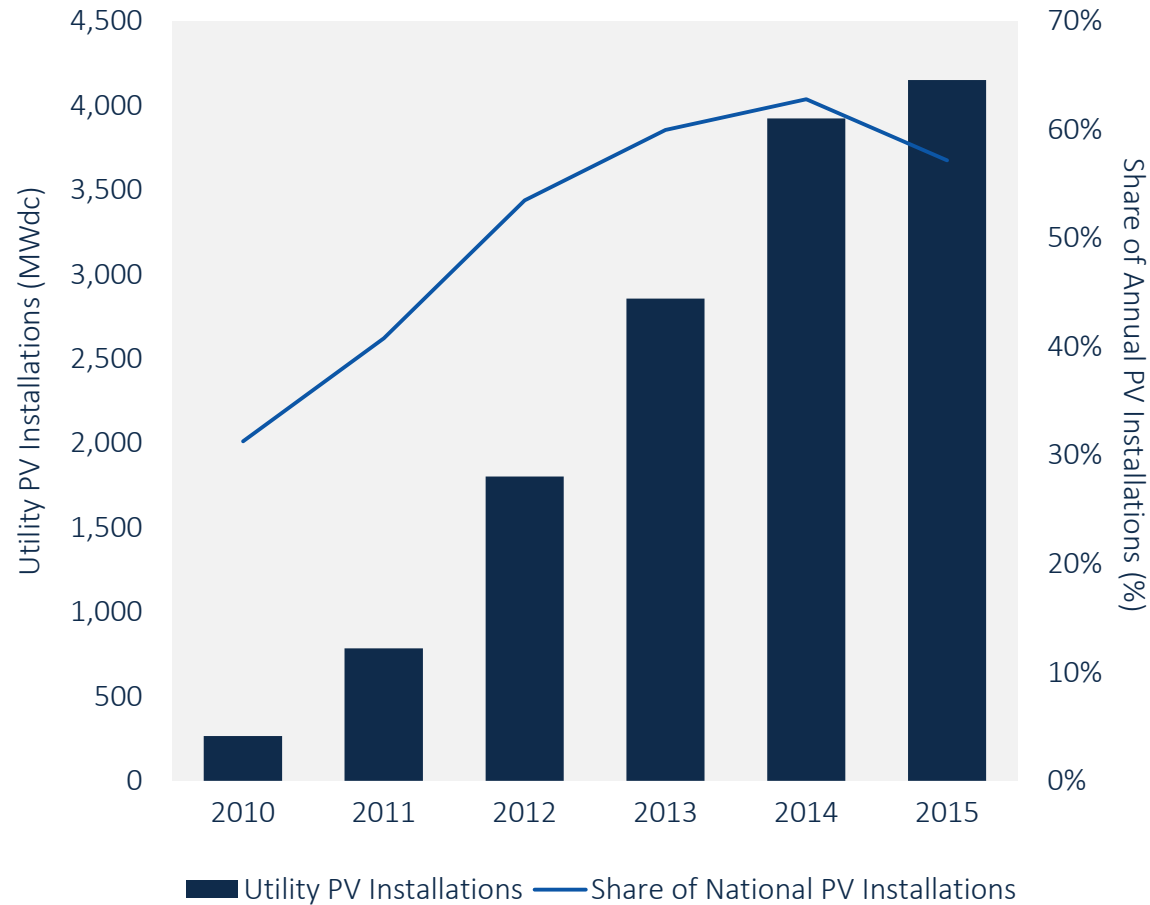
Utility Scale PV Installations:
California vs. Rest of Top 10 States vs. Rest of U.S.



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

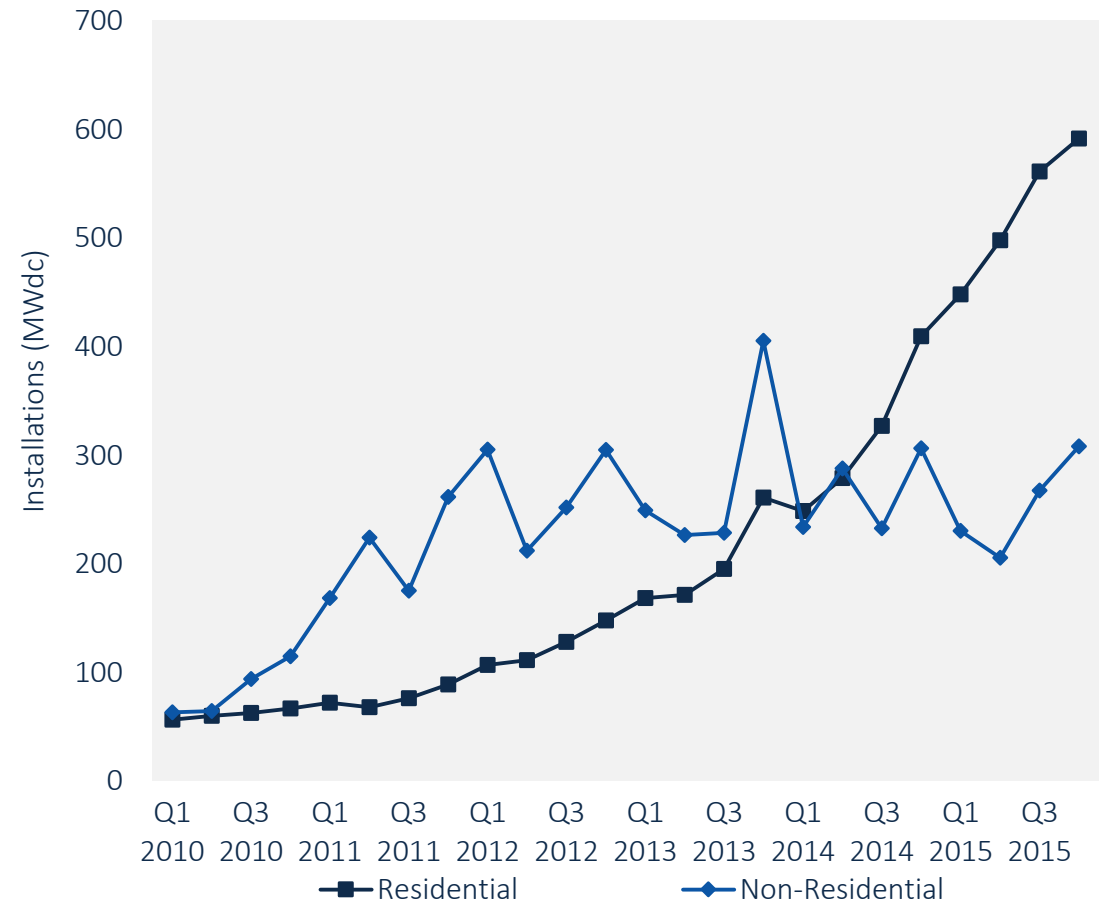
And within each market segment... distinct drivers and risks shape how the market is growing (or struggling) at the state level

Utility PV:
Market Drivers Evolving Beyond Renewable Portfolio Standards



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

Residential vs. Non-Residential PV:
A Tale of Two Segments Amidst Incentive Volatility



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

2. Looking Ahead: Rundown by PV Market Segment

What are the key questions shaping U.S. solar in both distributed and utility scale PV?

Utility Scale Solar Market Outlook

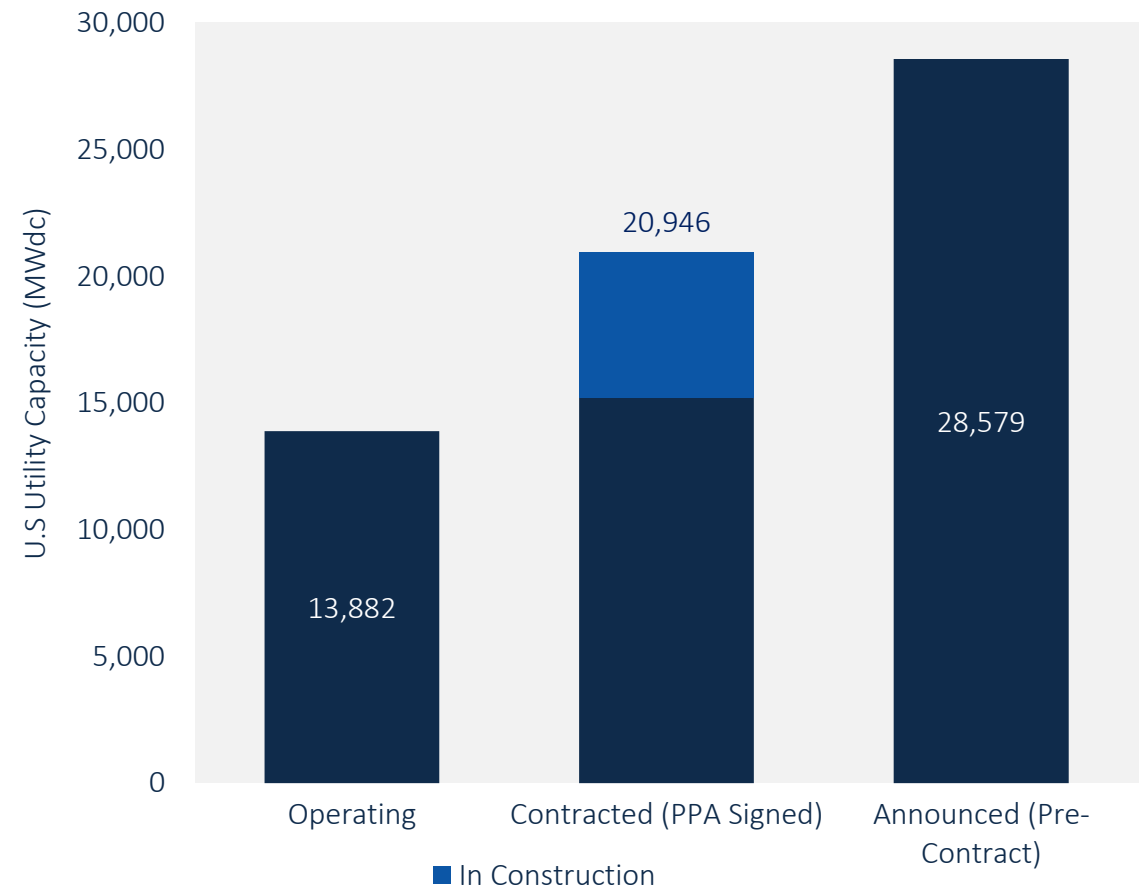
Where and why is demand emerging beyond Renewable Portfolio Standards?

Utility PV: Continued Growth and Diversified Demand Drivers

Utility PV Pipeline: Driven by Non-RPS Drivers

- **Utility PV in 2015:** Remains the bedrock driver of U.S. solar installation growth, accounting for 57% of capacity installed in 2015
- **At least 50% of 2016 capacity expected to come online will come from non-RPS market drivers:**
 - With PPA prices for utility PV now ranging between \$35/MWh and \$60/MWh, utility PV demand is expanding beyond RPS obligations
 - PURPA was the largest driver of non-RPS utility PV in 2015 accounting for 22% of all projects brought online last year
 - And PURPA is one of a handful of emerging market drivers fueling recent utility PV procurement...

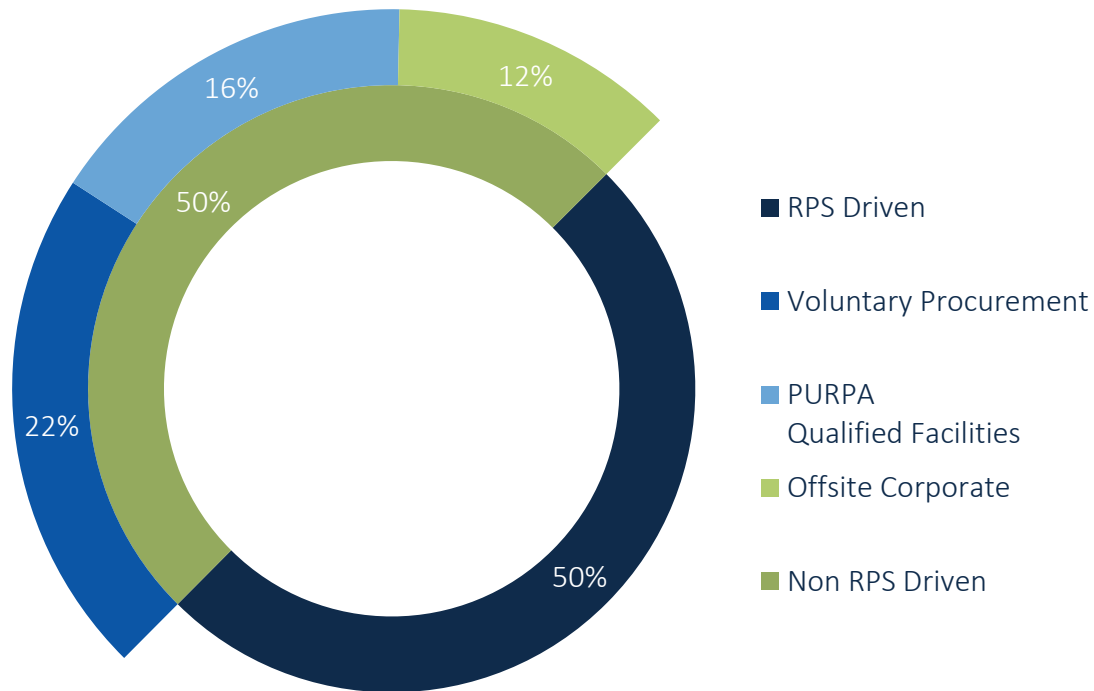
U.S. Utility PV: Operating Capacity vs. Project Pipeline



Source: U.S. Utility PV Market Tracker

Utility PV Project Pipeline: Tapping into Emerging Market Drivers

U.S. Utility PV Pipeline: RPS vs Non-RPS Driven Pipeline



RPS-Driven – Utilities procure due to legislated or regulatory mandated targets for solar and renewable energy.

Voluntary Procurement – Utilities procure and own PV outside of any obligations to meet state renewable portfolio standards.

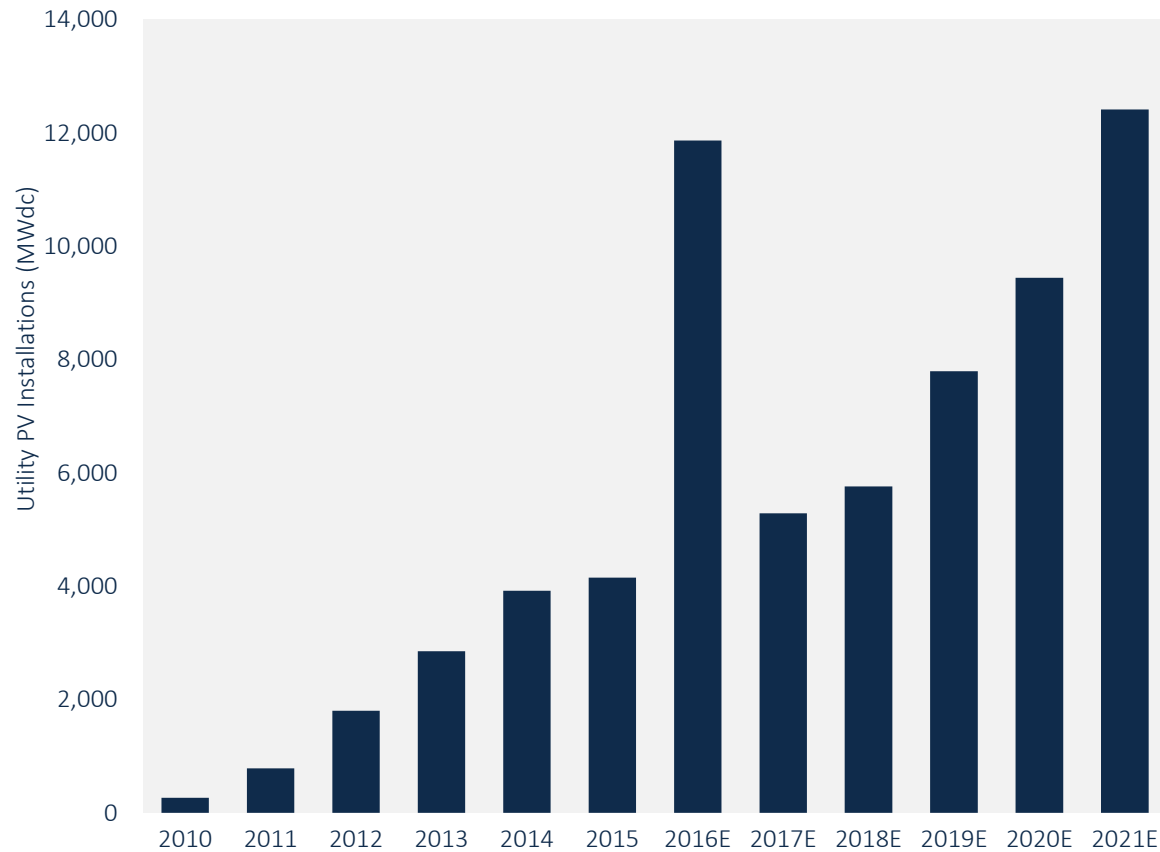
PURPA – The Public Utility Regulatory Policy Act was passed in 1978 to promote energy conservation and renewable energy development. Under PURPA, utilities are required to purchase energy and capacity from qualifying facilities (QFs) at their incremental or avoided costs.

Retail Procurement – An increasing portion of U.S. utility PV is now being driven by non-utility entities looking to procure renewable energy to achieve economic savings or to reach voluntary renewable energy goals.

Source: U.S. Utility PV Market Tracker

U.S. Utility PV Market Outlook

Annual Utility PV Installation Forecast: 2010-2021E



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

Near Term (2016) and Long Term (2017-2021) Market Outlook

Utility PV: 11,867 MWdc in 2016; 186% growth over 2015

Near Term: 2016 Utility PV Boom

- With over 20 GW in development and 6 GW of projects in construction, 2016 is on track to have more than 11.8 GW of utility PV come online.

Long term: ITC Extension Impacts and the changing landscape

- As the ceiling on competitive PPA pricing continues to drop, the utility PV market is expected to be primarily driven by cost competitive market drivers outside Renewable Portfolio Standards.
- The utility procurement landscape will continue to evolve too, as municipal utilities, co-ops, and community choice aggregators drive a growing portion of projects in the 1 MW to 50 MW range.

Non-Residential Solar Market Outlook

*Why has the market struggled to grow over the past couple of years?
And why does GTM Research expect a rebound in 2016?*

Non-Residential Solar: State incentive and policy bottlenecks constrain major state markets

National Level Trends for Non-Residential Solar

Non-Residential PV in 2015: 1,011 MWdc installed, dropping 4% over 2014

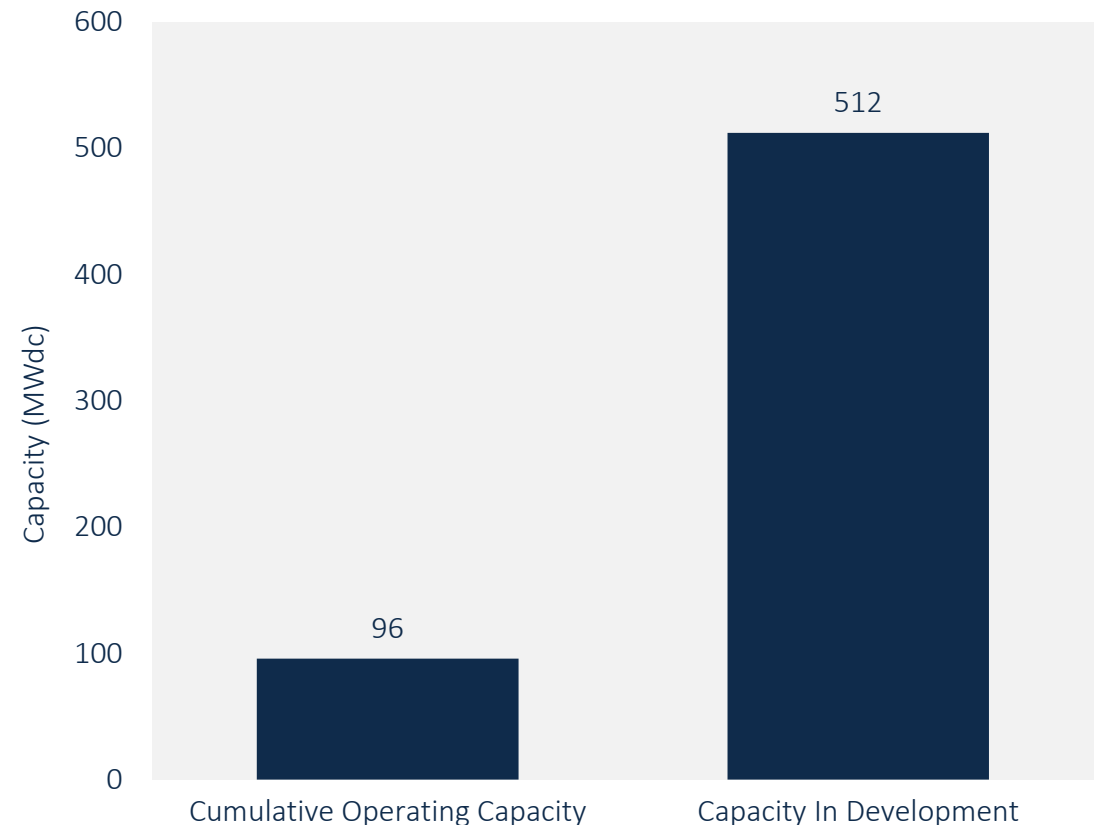
Net Metering Caps Limit Installation Growth and Customer Origination

- **Massachusetts:** Growth in one of non-residential solar's primary state markets has been limited by the waning pipeline of projects under preexisting NEM caps. The timeline for expanding the utilities' NEM caps in MA remains a key policy driver of a strong national level rebound in 2016.

Weak State and Utility Incentive Levels Constrains Growth

- The Northeast remains characterized by oversupplied SREC markets, most notably in NJ, while markets out West have seen weak demand as utility incentive programs are eliminated or near incentive funding depletion.
- *Silver linings to the 2016 outlook rely on pent-up community solar demand and emerging market drivers for 1 MW+ development in California...*

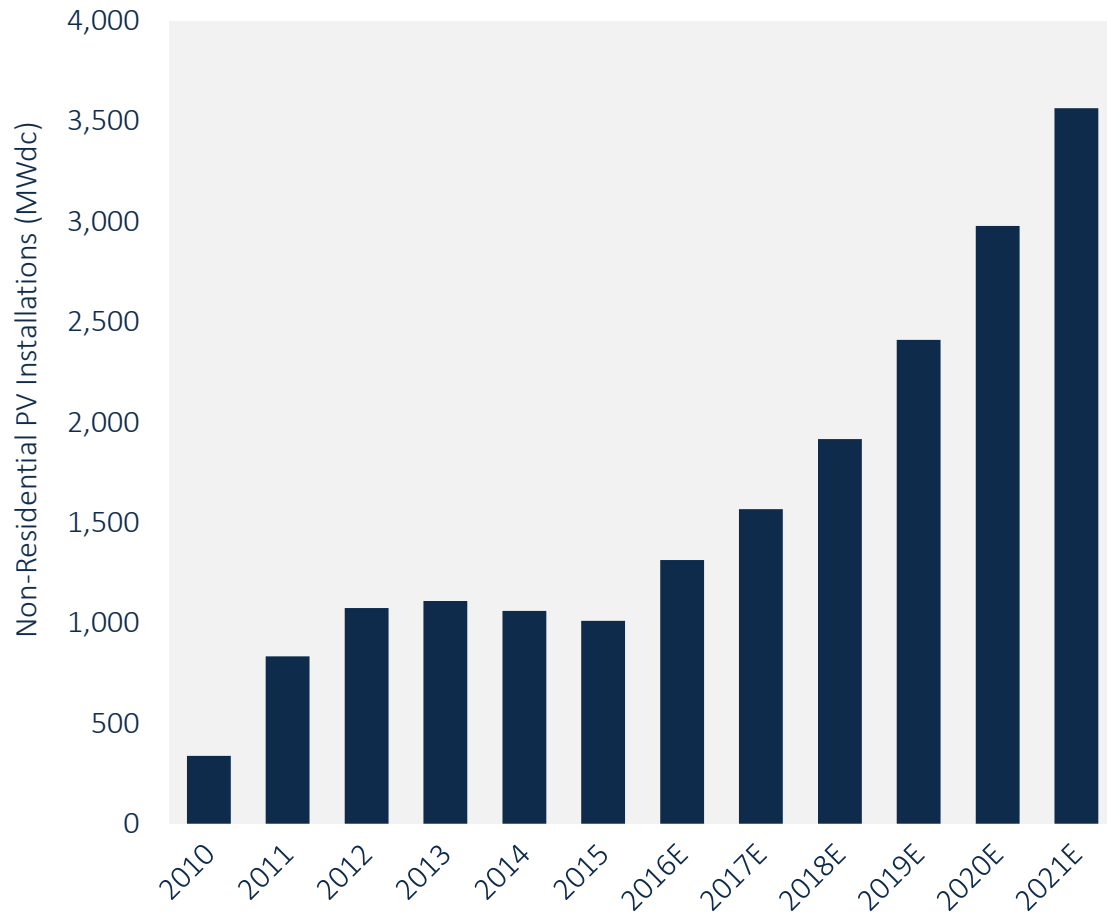
Community Solar: Operating Capacity vs. Project Pipeline With 2016/2017 COD



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

U.S. Non-Residential Solar Market Outlook

Annual Non-Residential PV Installation Forecast: 2010-2021E



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

Near Term (2016) and Long Term (2017-2021) Market Outlook

Non-Residential PV: 1,314 MWdc in 2016; 30% growth over 2015

- **Near Term: Demand Fueled by Large Scale (1 MW+) Development**
 - **2016:** A rebound is expected via incremental recovery in oversupplied SREC markets, increased dependence on CA demand via solar-friendly rates and 1 MW+ development, and pent-up community solar demand.
- **Long Term: Saved By the Federal ITC Extension (Especially Small Commercial)**
 - The ITC extension is expected to spur an additional 4 GW of non-residential solar through 2020, with commercial solar economics more reliant on the federal ITC than residential given rate design.
 - Long term growth will increasingly be pegged to the sub 1 MW non-residential PV market, as third party financing solutions expand into the small and medium sized commercial customer bases.

Residential Solar Market Outlook

What does the future hold for residential solar in an evolving policy landscape for net metering and rate design?

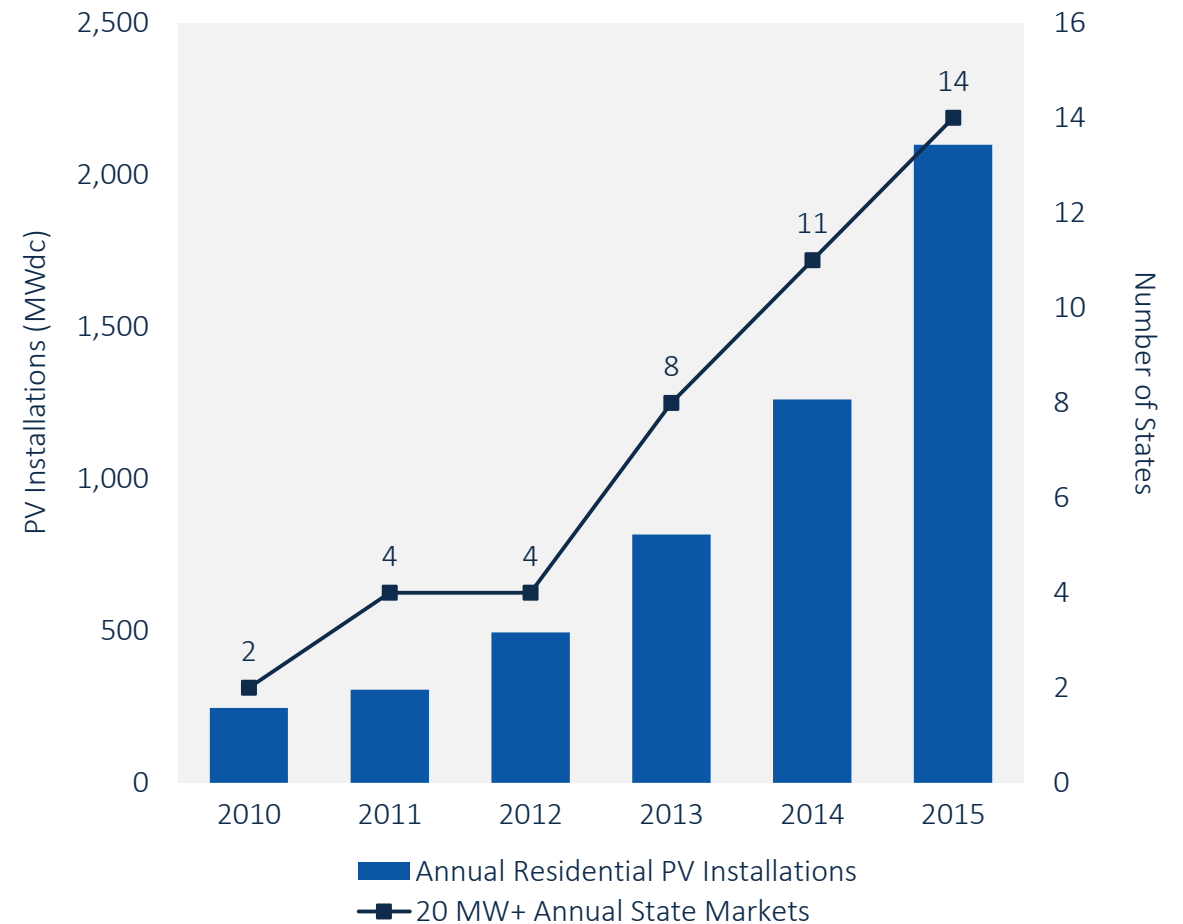
Residential Solar: The Pros and Cons of a Consolidated Geographic Demand Landscape

National Level Trends for Residential Solar

Residential PV in 2015: 2.1 GWdc installed, growing 50%+ on annual basis for the fourth consecutive year

- **Glimpses of demand diversification:** The residential solar market is showing signs of geographic diversification, with the number of 20 MW annual state markets for residential solar increasing threefold over the past four years.
- **But growth is still being primarily driven by the top 10 states, heightening the impact of NEM reform across a handful of states:**
 - The top 10 states drove 88% of annual installations. But 7 of those states have considered or approved reforms to net metering and rate design that roll back rooftop solar savings.
 - Most notably, the Nevada PUC recently approved reforms that phase in increased fixed charges and reduce compensation for solar exports, all of which is expected to result in a 90%+ reduction in new NV residential installations in 2016.

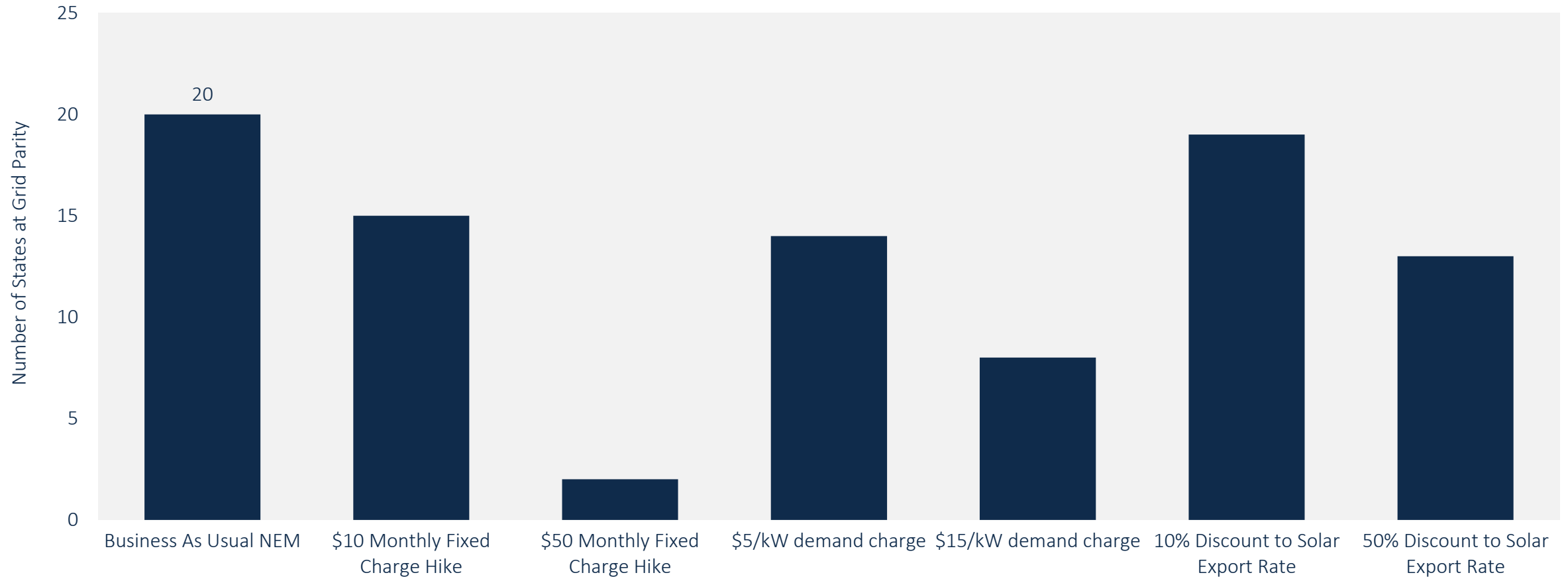
Annual Residential PV Installations vs. Number of 20 MW Annual State Markets



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

How do NEM reforms impact the number of states at grid parity in 2016?

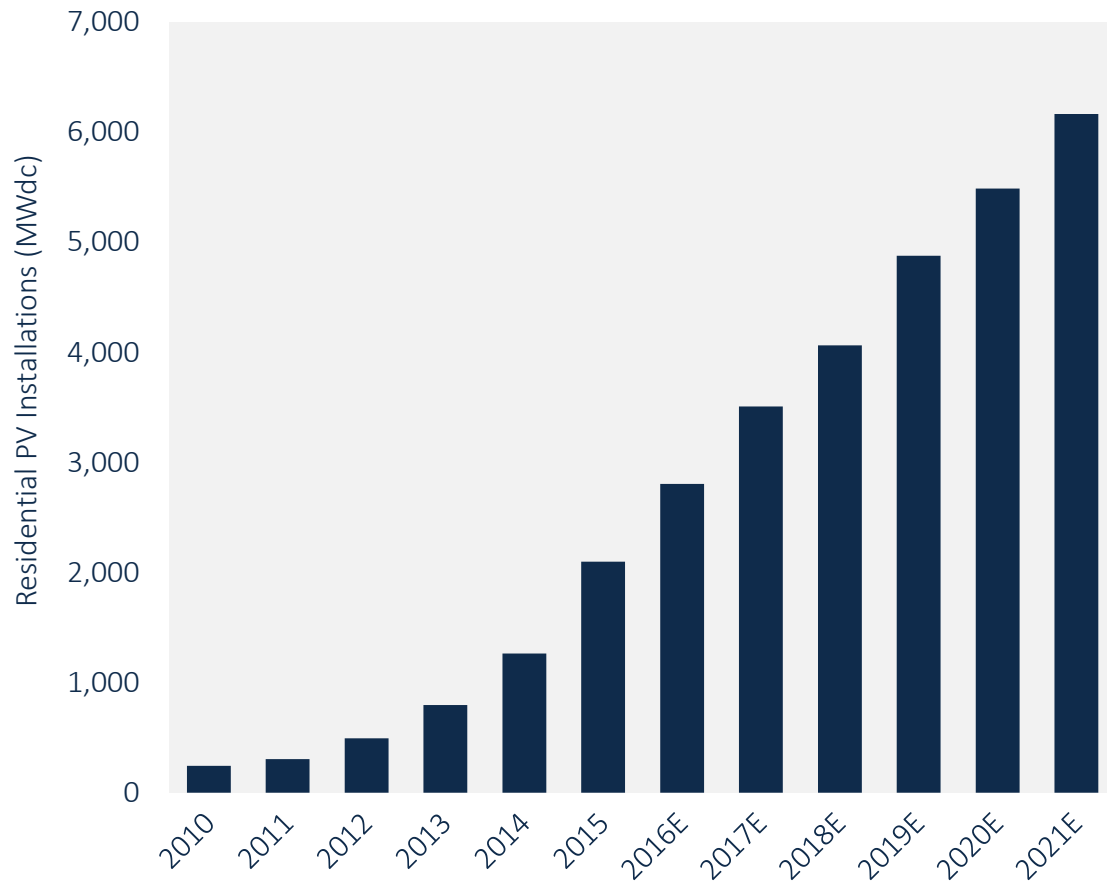
Number of States at Grid Parity in 2016: Business-as-Usual NEM vs. NEM Reform Scenarios



Source: GTM Research, U.S. Residential Solar Economic Outlook

U.S. Residential Solar Market Outlook

Annual Residential PV Installation Forecast: 2010-2021E



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

Near Term (2016) and Long Term (2017-2021) Market Outlook

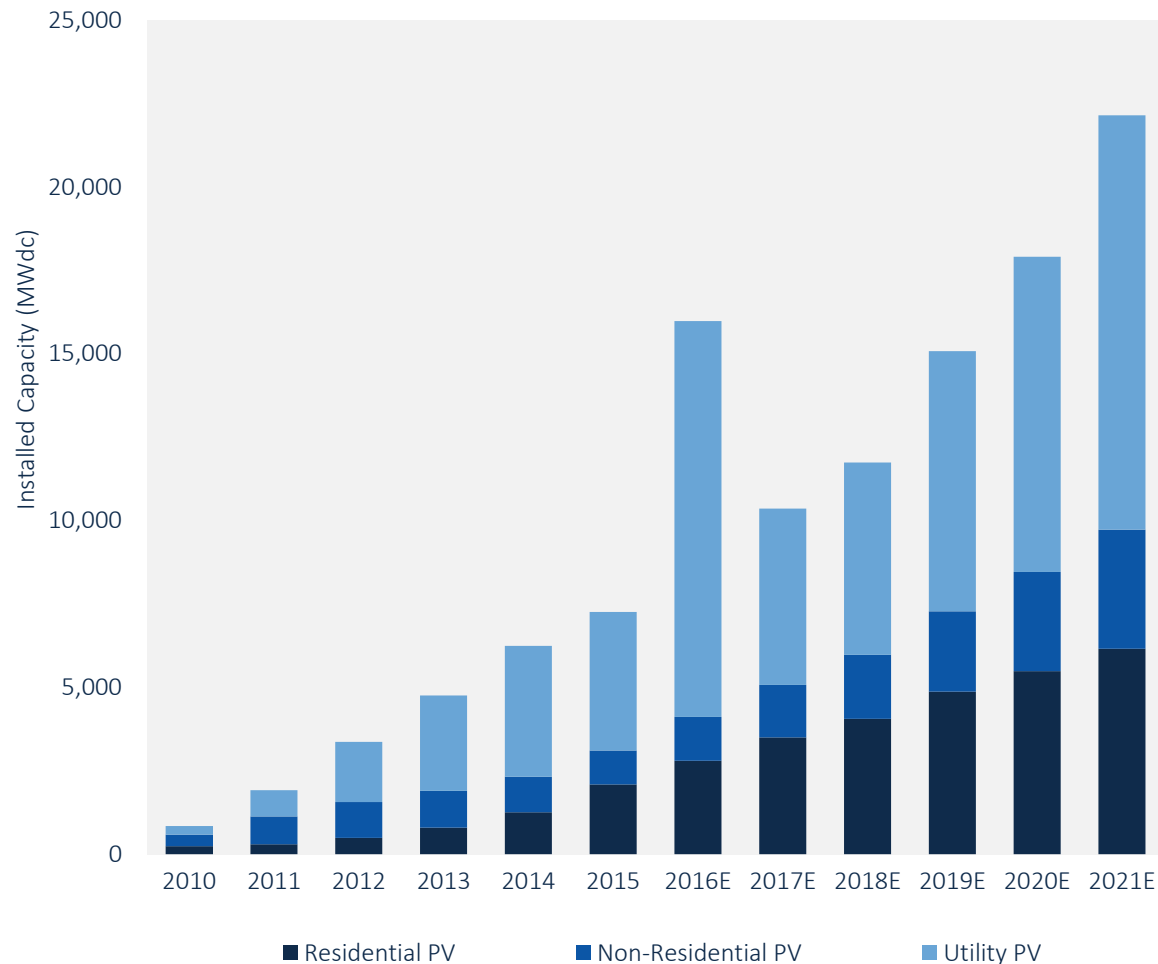
Residential PV: 2,804 MWdc in 2016, 34% growth over 2015

- **Near Term: Business-as-Usual Policy Landscape Yields Strong Growth**
 - Over ten states will install at least 40 MWdc in 2016, but growth remains pegged to California, which is expected to add nearly 1.5 GWdc in 2016 alone.
 - Largely favorable outcomes in NEM reform debates (i.e. California) will support growth in most major state markets in 2016.
- **Long Term: Demand Diversification (Plus NEM Reform Debates) To Accelerate via Federal ITC Extension**
 - By 2017, more than half of all states will be at or below grid parity (residential PV LCOE vs. year 1 electricity savings).
 - As residential PV penetration in major state markets nears that of Hawaii's, residential PV demand is linked to NEM reforms that result in incremental, rather than stark, rollbacks to rooftop PV compensation.

3. Putting It All Together: 4 Predictions for 2016

With the recent extension of the federal Investment Tax Credit, state and utility level drivers and risks move to the forefront of the U.S. solar market outlook.

Four state and utility level trends to watch in 2016 for U.S. solar



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

Four Key Predictions: U.S. Solar in 2016

1. Time-of-use rate structures will become the next hot topic in debates about the value of rooftop solar
2. Community solar's breakout year is officially 2016, just one year later than expected
3. At least 1 GW of utility-scale solar will be procured by customers that are not utilities
4. A majority of the utility PV pipeline will pack projects into 2016 as if the federal ITC were still scheduled to step down

About Greentech Media



NEWS/ONLINE

Greentech Media delivers business-to-business news, analysis and events at the forefront of the global energy transformation. Our coverage area extends across the clean energy industry with a focus on solar power and the electric utility market's evolution. Greentech Media's industry-leading coverage is provided by a team of analysts from our market intelligence arm, GTM Research, as well as our world-class journalists and global network of expert contributors.



RESEARCH

GTM Research is the market analysis and consulting arm of Greentech Media. GTM Research is comprised of analysts covering solar, grid edge, and energy storage markets. Our analysts combine diverse backgrounds in energy, environmental, emerging technology, information technology and strategic consulting sectors. This diverse team provides critical and timely market analysis in the form of research reports, consulting, and data subscription services.



EVENT

Greentech Media and GTM Research experts come together to produce all of Greentech Media's industry conferences throughout the year. These summits provide a platform for our latest market intelligence and draw together the industry influencers from organizations across the value chain.

Thank you!

Interested in other GTM Research products and services? Please visit www.gtmresearch.com or contact sales@greentechmedia.com

April 2016

gtmresearch