U.S. Solar Market Insight: Q4 2016

State and Future of U.S. Solar Markets

Austin Perea
Solar Analyst
Perea@GTMResearch.com

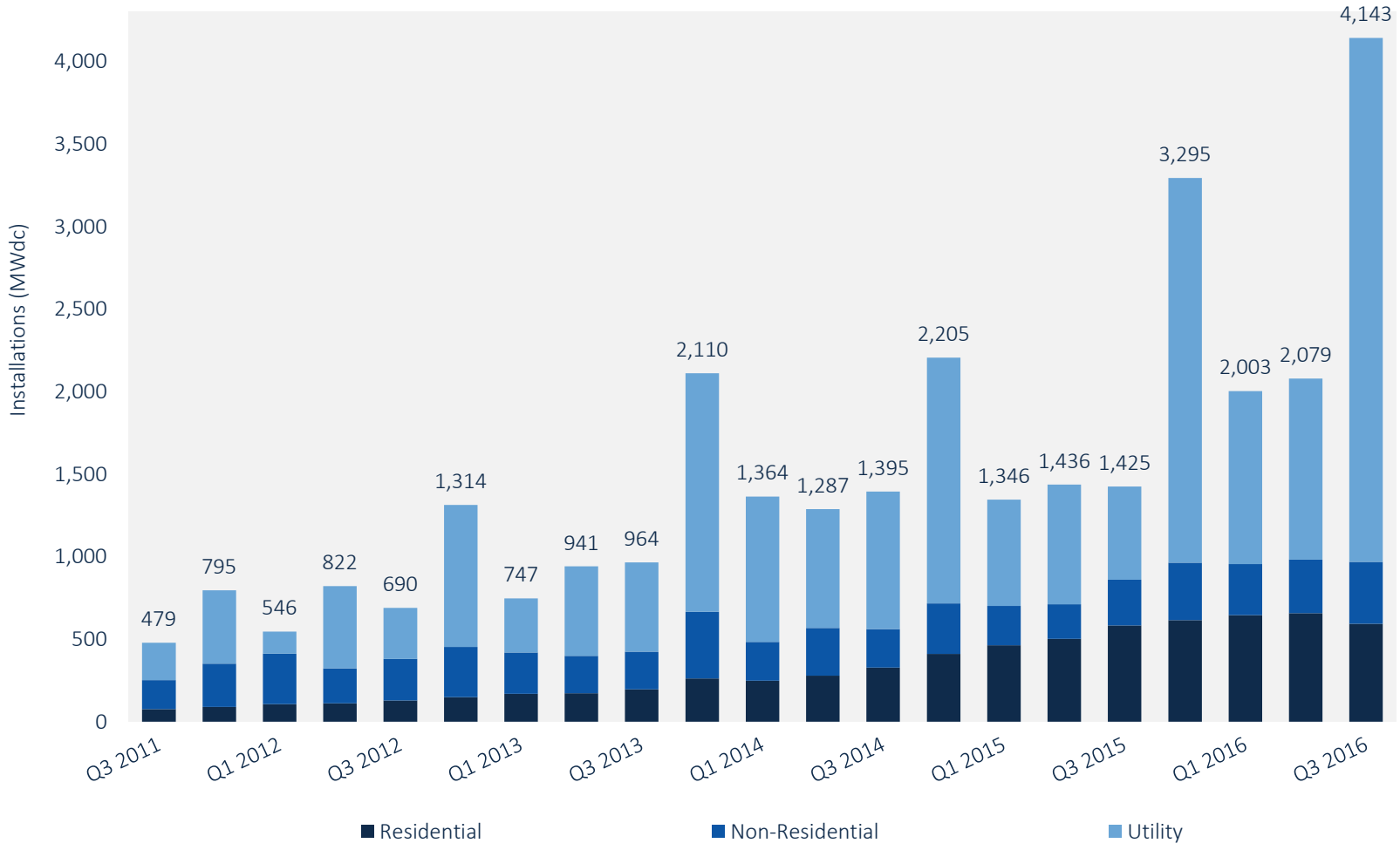
12/14/2016

gtmresearch

Contents

1. National Overview & Key Market Drivers

Q3 2016 – The Largest Quarter for Solar PV



Q3 2016: 4,143 MWdc installed

Q1-Q3 2016: 8,225 MWdc installed

Utility PV: 3,174 MWdc

- ~75% of total PV capacity installed in Q3 2016; ~65% of total PV installed in 2016 to-date
- Contracted utility PV pipeline currently totals 19.9 GWdc

Non-Residential PV: 311 MWdc

- Up 15% from Q2 2016
- Up 37% over Q3 2015

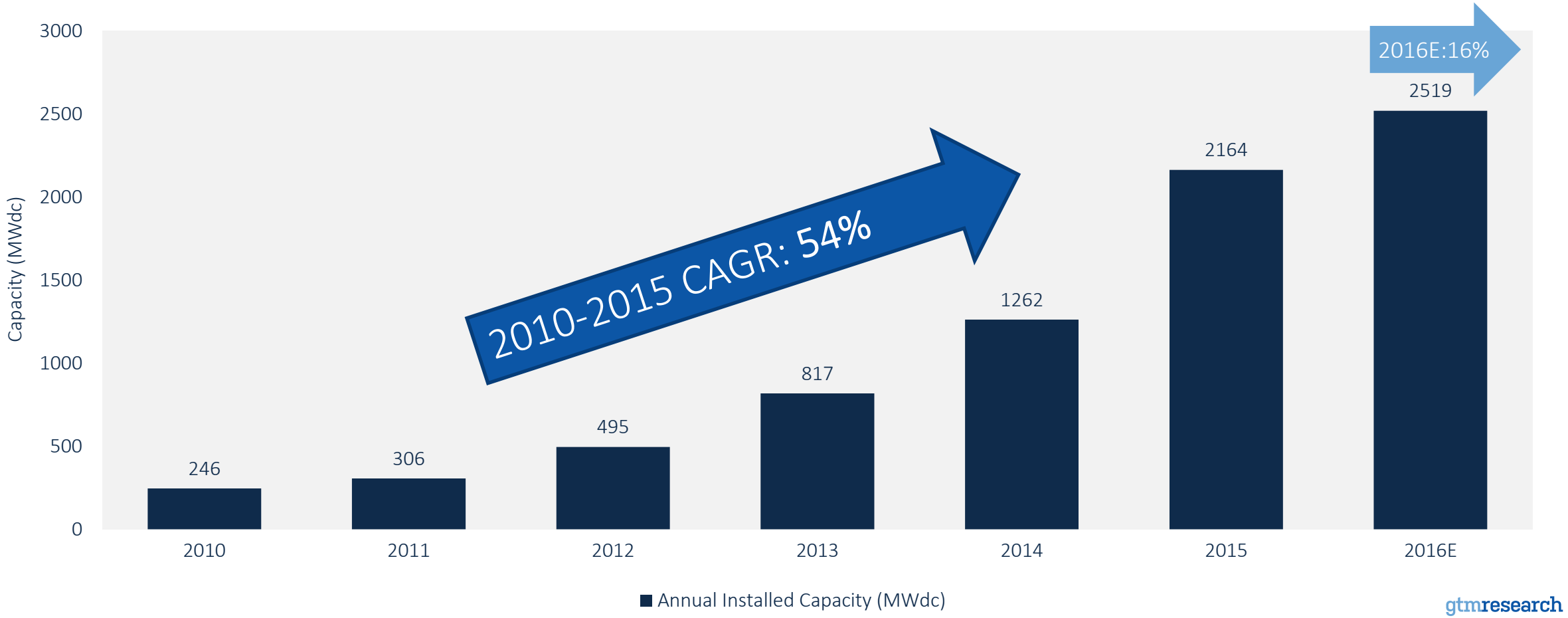
Residential PV: 593 MWdc

- Down 10% over Q2 2016
- Up 2% over Q3 2015

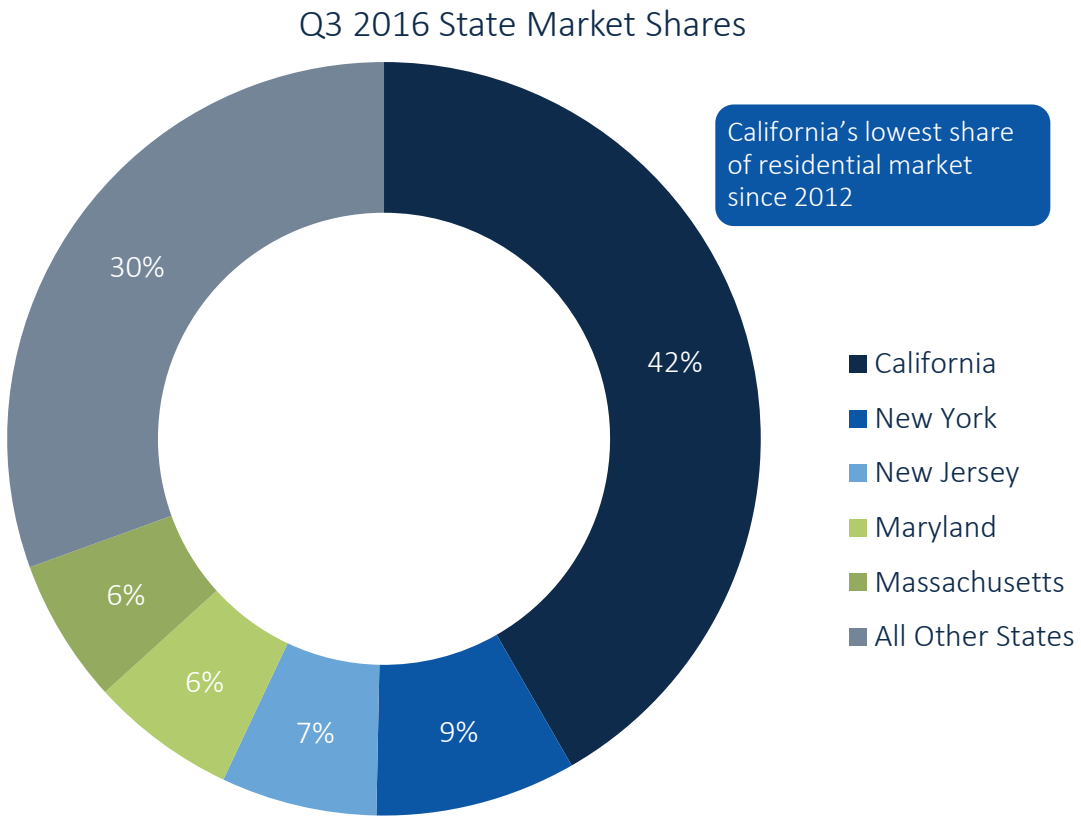
2. Market Segment Breakdown: Residential PV

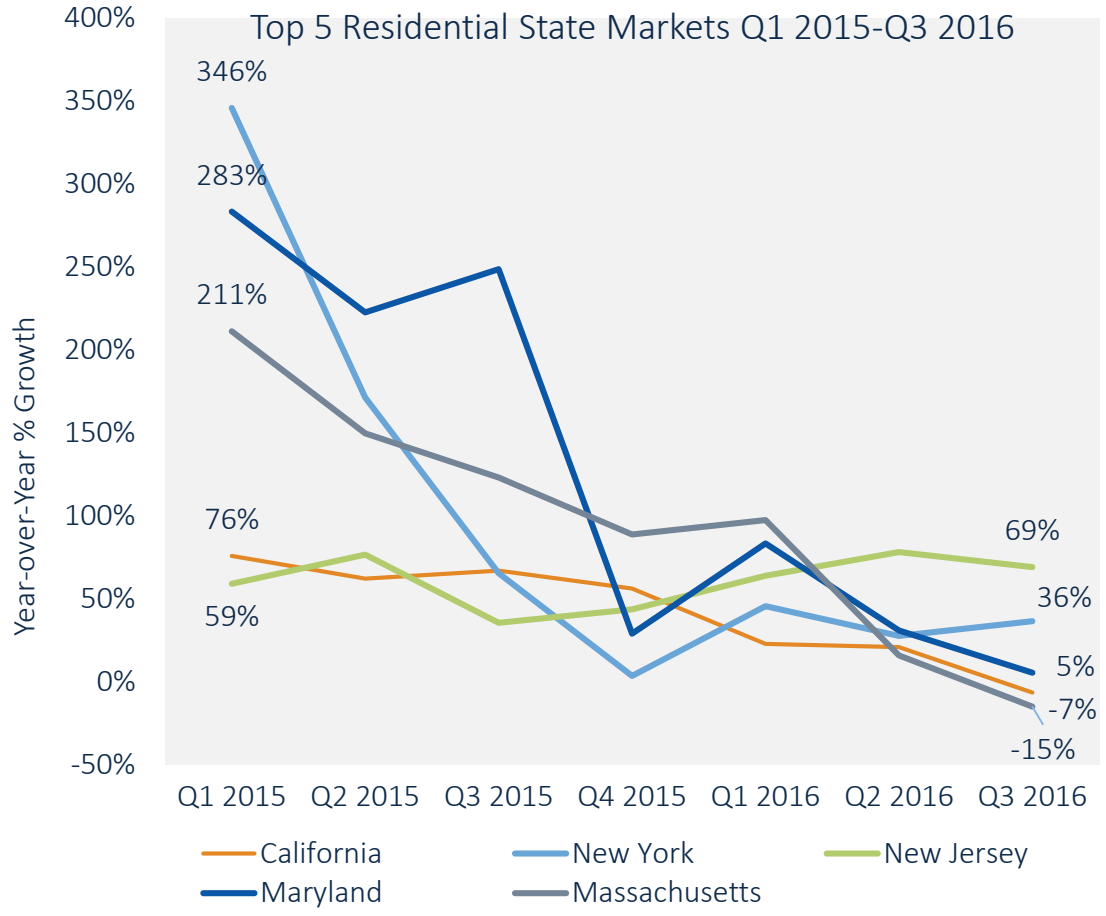
2016: The Year of Major Market Slowdown?

Residential solar has seen considerable growth through the first half of the decade



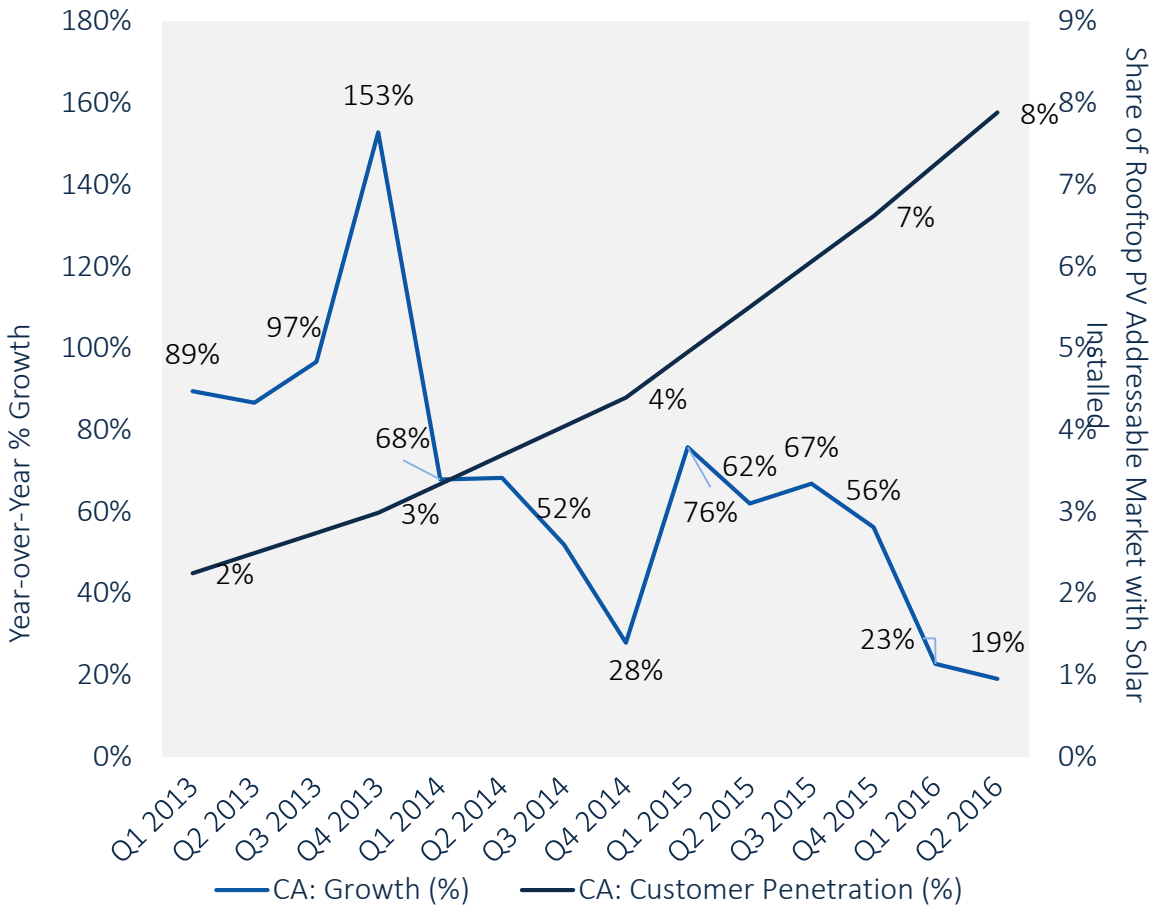
Residential PV continues to be a geographically consolidated market





Customer fatigue and ongoing NEM & rate design battles remain hurdles for residential PV

California Residential Growth % vs. Customer Penetration



Source: GTM Research/SEIA, Q3 2016 U.S. Solar Market Insight

National Level Trends for Residential Solar

Major market growth increasingly inhibited by customer fatigue and market saturation

- Protracted lead generation timelines
- Higher customer acquisition costs
- Declining lead conversation ratios

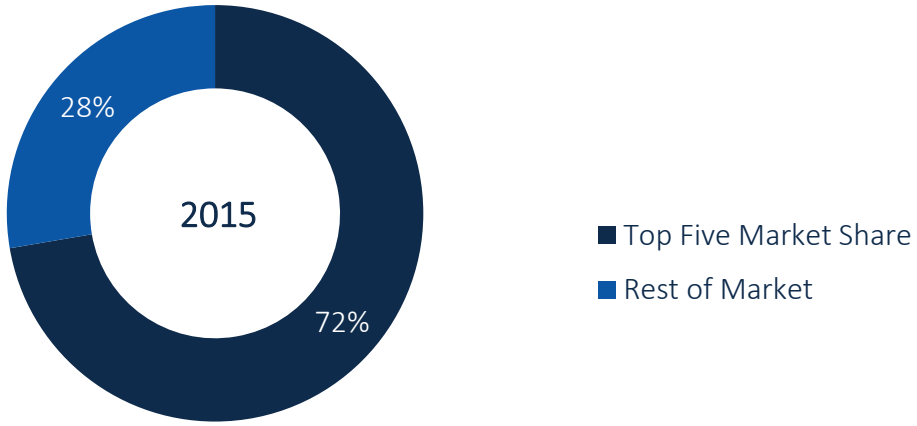
Longer sales cycles leading to slower growth among California and other key markets

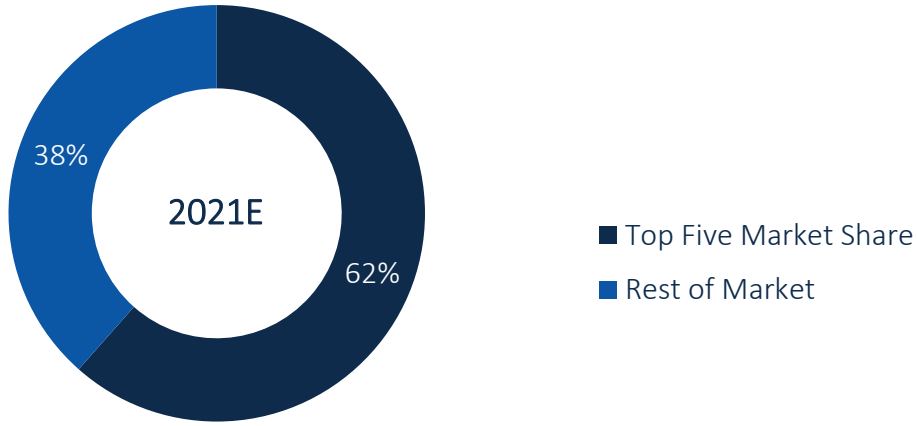
Additionally, NEM reform and rate design continues to present near- and long-term risk to DG economics

Emerging market most risk most pronounced

- **Nevada:** Rollback to NEM has cratered promising top ten market in 2016
- **Utah:** Utility has proposed new discriminatory solar rate class
- **Arizona:** Peak demand charge has potential to slash savings in 2017
- **California:** Transition to NEM 2.0 complicates sales process for installers

Emerging markets will partially offset major market decline





No state-level net metering policy – state growth primarily supported by utility-level rebates

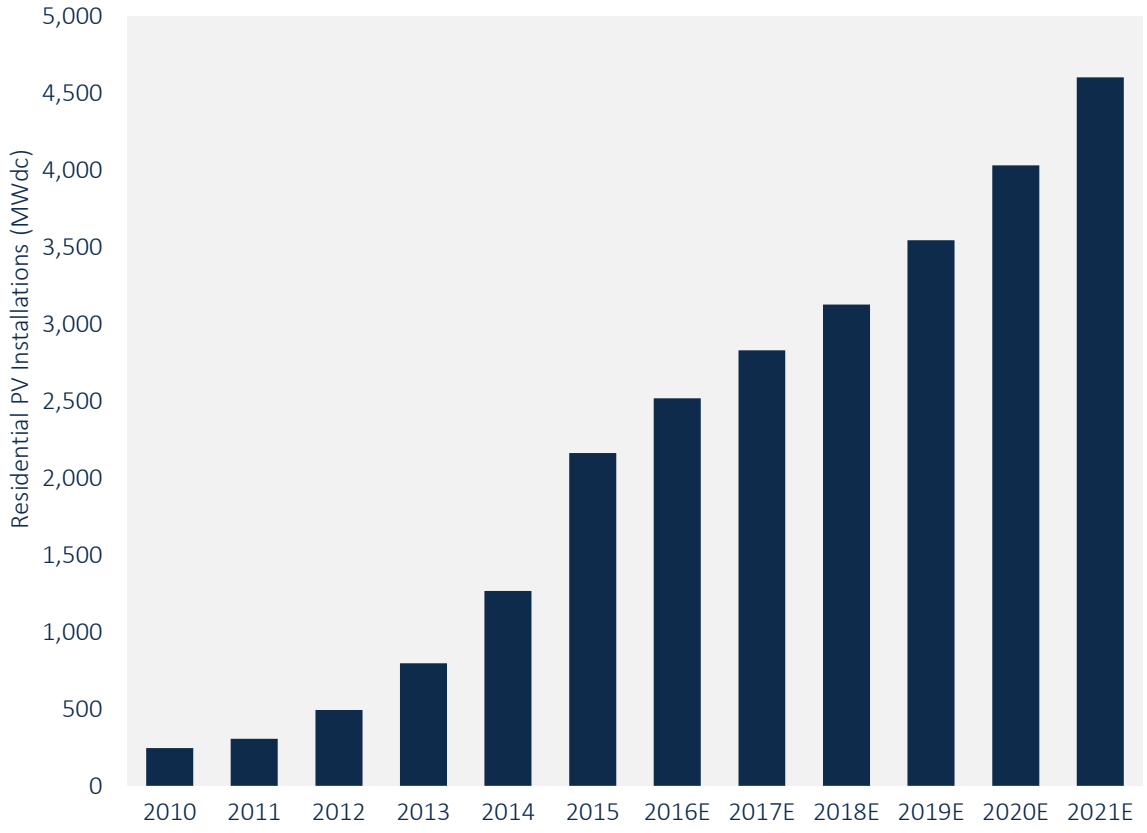
- With utilities offering robust incentives the state has recently become top ten market
- Austin Energy VOST continues to attract national installers

20% aggregate NEM cap, retail-rate NEM but looming tax credit expiration and NEM uncertainty pose risk

- In-state tax credit has fueled growth in H1 2016 with 12,000 applications in 2016 vs. 3,000 in 2015
- 20+ MW installed in Q3 and could see significant demand pull-in from customers trying to qualify for the tax credit and grandfathered retail-rate NEM

U.S. Residential Solar Market Outlook

Annual Residential PV Installation Forecast: 2010-2021E



Near Term (2017) and Long Term (2018-2021) Market Outlook

Near Term: Growth to continue, though at slower rates than expected

- Despite NEM policy certainty across most major state markets, deceleration is expected to continue
- That said, major markets will continue to account for a large share of reduced growth with occasional demand pull-in and emerging market growth also contributing

Long Term: Demand diversification to accelerate via Federal ITC Extension

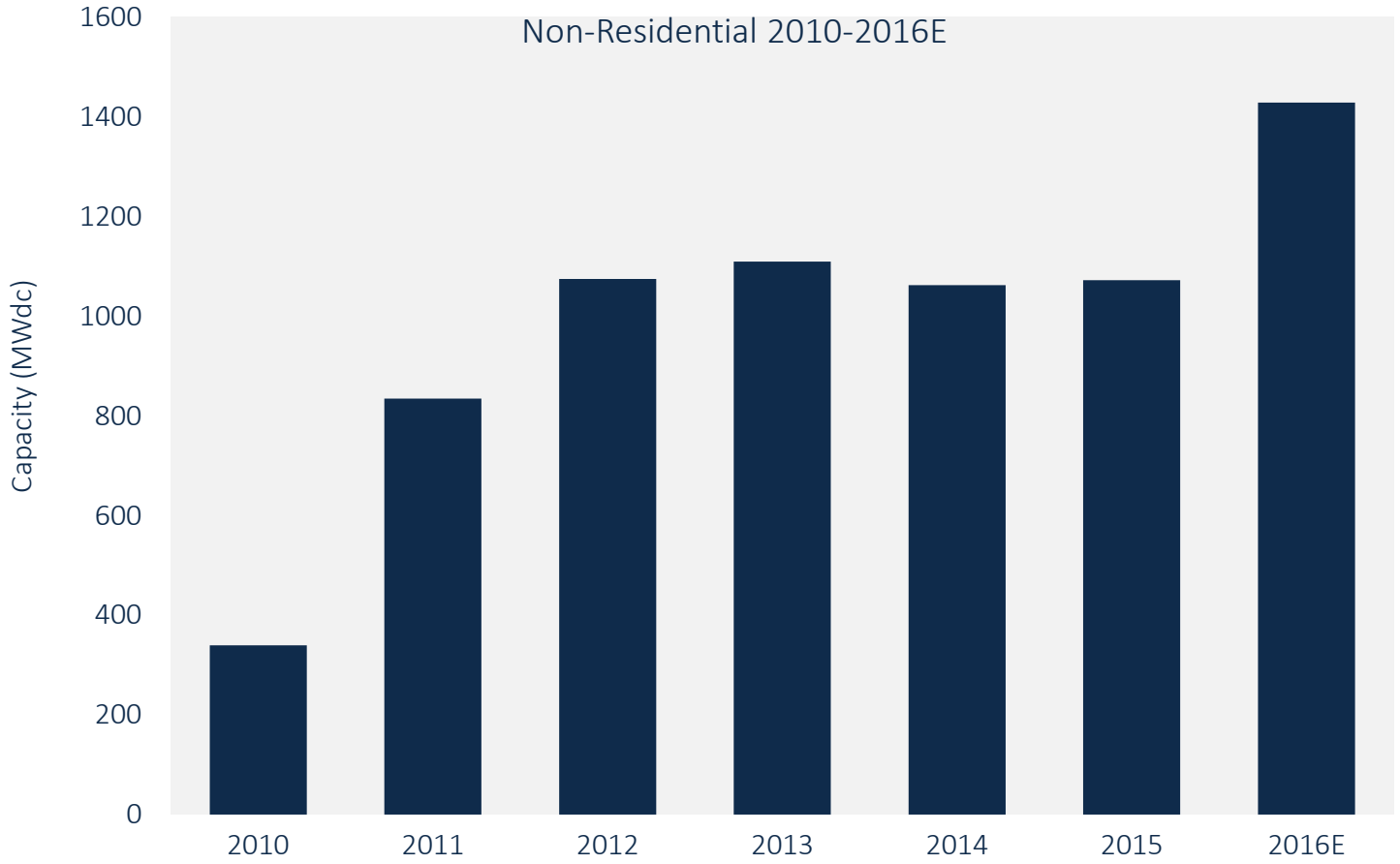
- Policy certainty in major state markets will provide strong baseline growth for residential PV though rate of growth will be slower than in previous years
- Demand diffusion will continue, as secondary state markets are already surpassing growth rates of major states and are poised to assume a larger share of the market
- Growth will depend on the extent to which installers can adapt to evolving customer acquisition landscape and tap in to new customer demographics

Source: GTM Research/SEIA, Q4 2016 U.S. Solar Market Insight

3. Market Segment Breakdown: Non-Residential PV

The Little Sector That Could

Non-Residential PV Overview – Where's the upside?



2016 installations poised to benefit from:

Community solar pipeline realization

- Upside stems from nearly **300 MW** of community solar projects in development

California demand pull-in

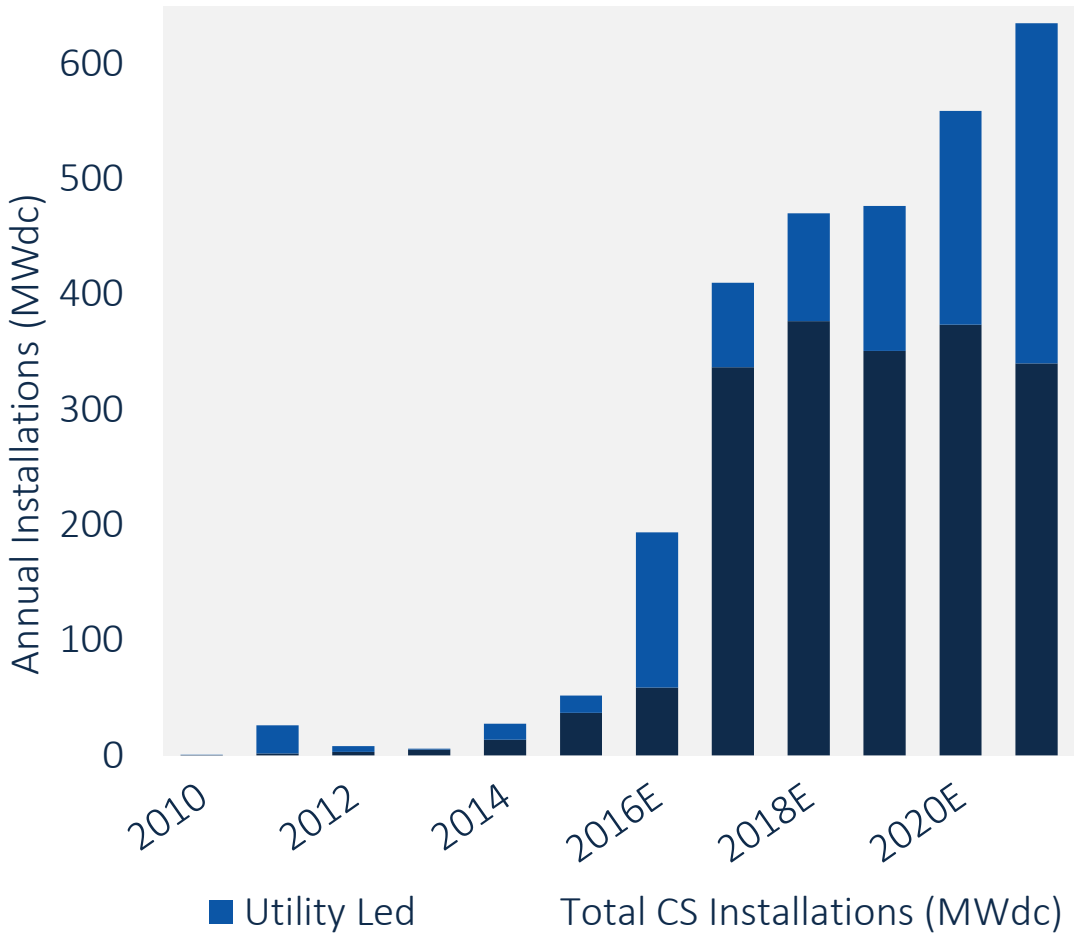
- Solar-friendly rate design
- Customer continue to leverage NEM-Agg

Non-residential PV expected to experience reboot

Traditional C&I still struggling

- Rate design still matters
- Declining incentive environment
- Lack of credit-worthy offtakers
- NEM cap and structure uncertainty

Realizing the promise of community solar



Source: GTM Research

- **2016 Outlook:** Pent up demand unrealized due to…
  - 12+ month regulatory and legislative debates over
    - Interconnection cost upgrades
    - NEM capacity limits
    - Successor bill credit methodologies in lieu of full retail rate
- **3rd party led:** Boom and bust cycles to yield flat demand ranging between 300 – 400 MW per year beginning in 2017
  - **2017-2018 Booms:** Massachusetts and Minnesota
  - **2018-2020 Booms:** New York and Maryland
- **Utility led:** Majority of announced programs are 1 MW+, signaling market's beginning to mature beyond smaller scale, single project pilot programs

California's solar-friendly rate design and NEM 2.0 transition fueling commercial market

California's largest non-residential quarter ever?

California accounted for 52% of the non-residential market in Q3 – it's highest share of the commercial market ever

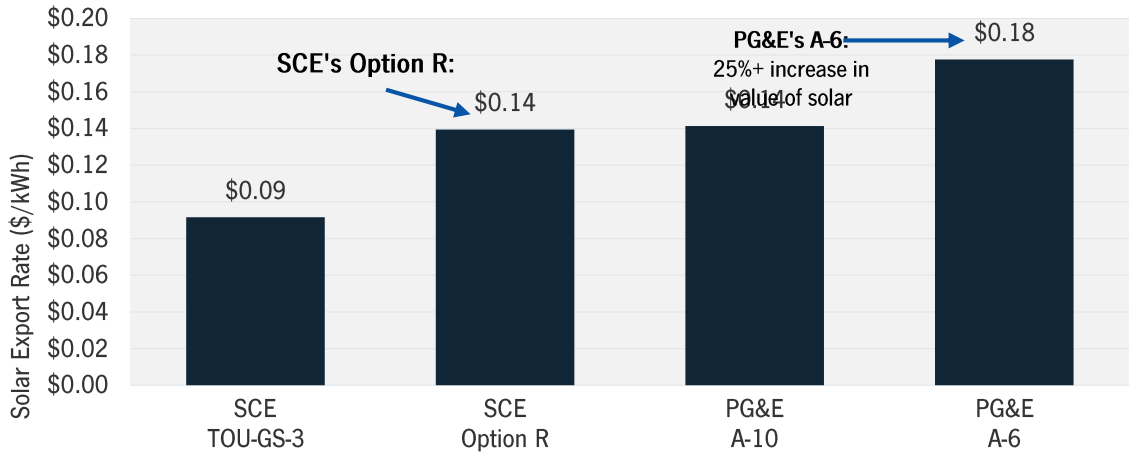
Solar-friendly tariffs such as SCE's Option R and PG&E's A-6 are made up by higher portion of volumetric charges, which solar is directly able to offset

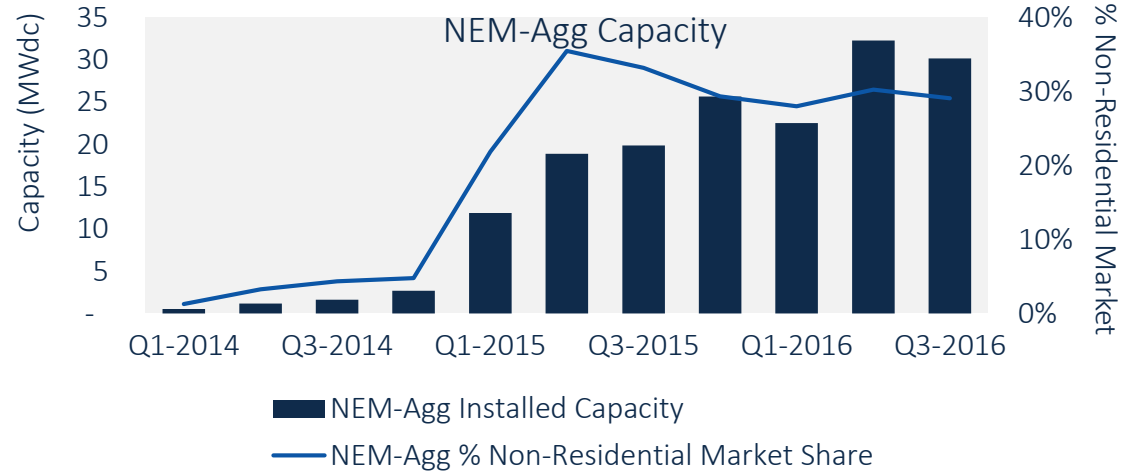
- SCE's Option R Tariff: 150 MW remaining in program
- PG&E's A-6: CPUC delayed closure for medium-size customers until March 31, 2017

No system size limitations under NEM 2.0 to fuel 1+ MW development

- NEM-A customers to benefit from higher system sizes

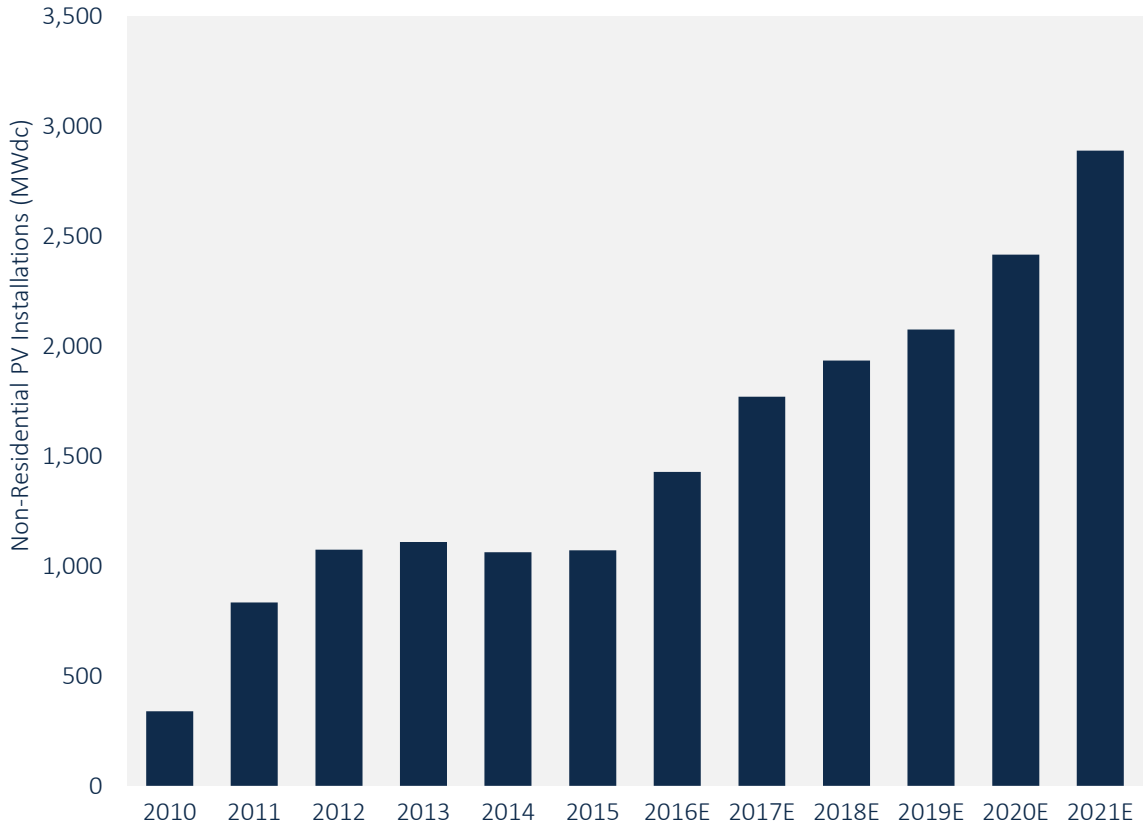
Average Commercial Solar Export Rates in CA: Default Tariff vs. Option R in SCE and PG&E





U.S. Non-Residential Solar Market Outlook

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



Source: GTM Research/SEIA, Q3 2016 U.S. Solar Market Insight

Near Term (2017-2018) and Long Term (2018-2021) Market Outlook

Near Term: Demand Fueled by Large Scale (1 MW+) Development

2017-2018: A gradual rebound is expected via:

- Pent-up third-party community solar demand in MA, MN, and CO and nearly 100 MWdc of utility-led community solar
- Strong CA demand via solar-friendly rates and 1 MW+ development as NEM 2.0 transition begins
- NEM cap relief in MA, though SREC successor program rollout delay risks pushing out greenfield origination opportunities

Long Term: Saved By the Federal ITC Extension (Especially Small Commercial)

- Long term growth will increasingly stem from the sub 1 MW non-residential PV market, as third party financing solutions expand into the small and medium sized commercial customer bases.
- As the effects of revised virtual NEM rules are felt in the Northeast, customer sited development and increasingly solar + storage will play a larger role in long term growth.
    - The exception to that trend is community solar, which remains a long term incentive-funded growth opportunity for offsite commercial development.

4. Market Segment Breakdown: Utility PV

Non-RPS procurement becomes largest driver of utility PV demand

Utility PV: Continued Growth and Diversified Demand Drivers

Utility PV Pipeline: Driven by Anticipated ITC Expiration and Non-RPS Drivers

Utility PV in 2016: Remains the bedrock driver of U.S solar installation growth

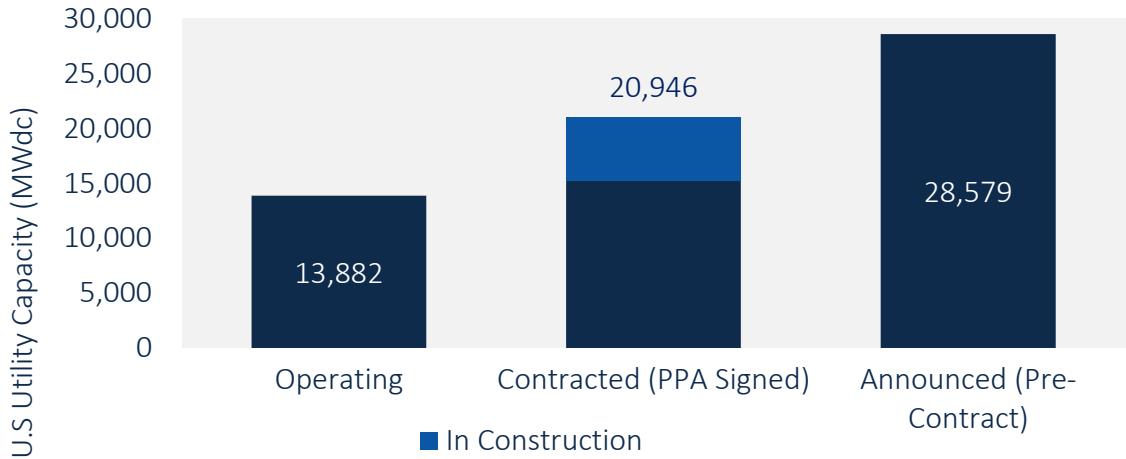
- 75% of capacity installed in Q3 2016
- 65% of capacity installed 2016 to-date

Large pipeline of utility PV initially procured under assumption of a Federal ITC expiration at the end of 2016

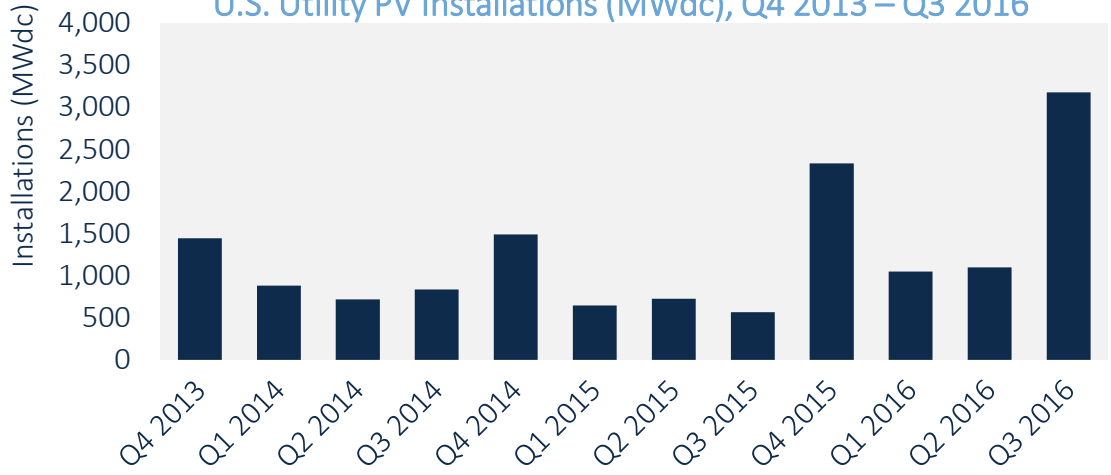
2016 marks the first year in which non-RPS procurement is largest market drivers

- With PPA prices for utility PV now ranging between $35/MWh and $60/MWh, utility PV demand is expanding beyond RPS obligations
- Voluntary procurement and PURPA have been the largest driver of non-RPS utility PV in 2016 together accounting for 40% of all projects brought online

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



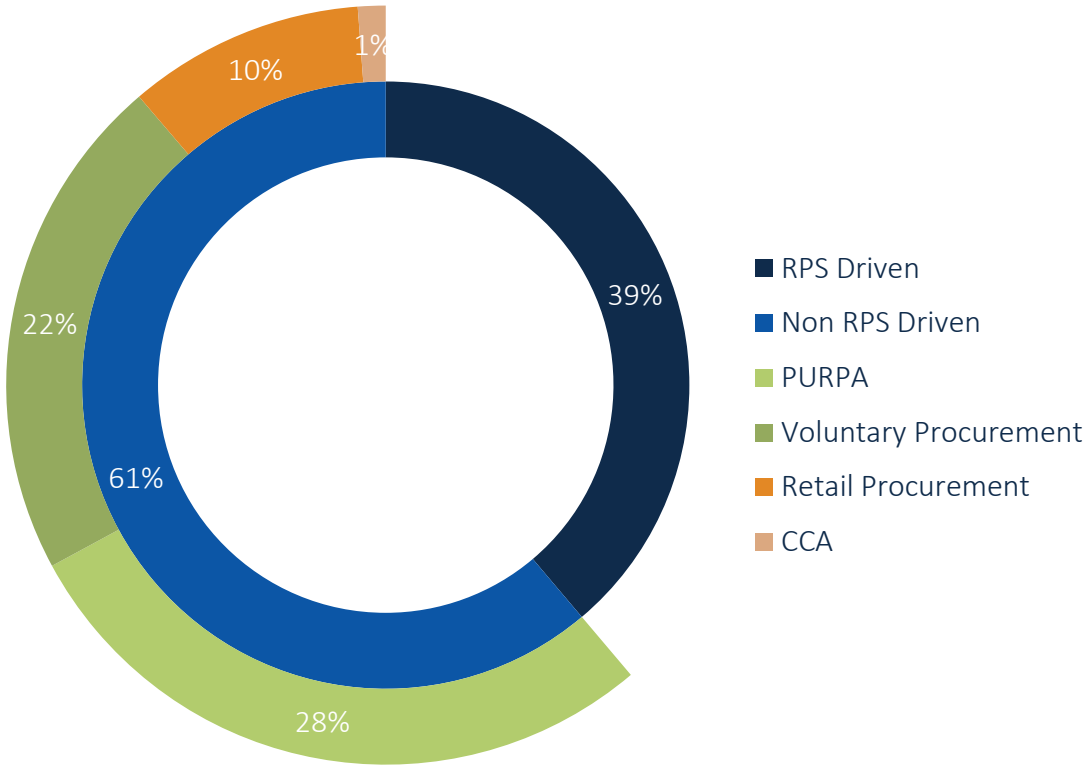
U.S. Utility PV Installations (MWdc), Q4 2013 – Q3 2016



Source: U.S. Utility PV Market Tracker

Non-RPS drivers drive the majority of pipeline procurement

U.S. Utility PV Pipeline: Segmented Market Drivers



Source: U.S. Utility PV Market Tracker

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

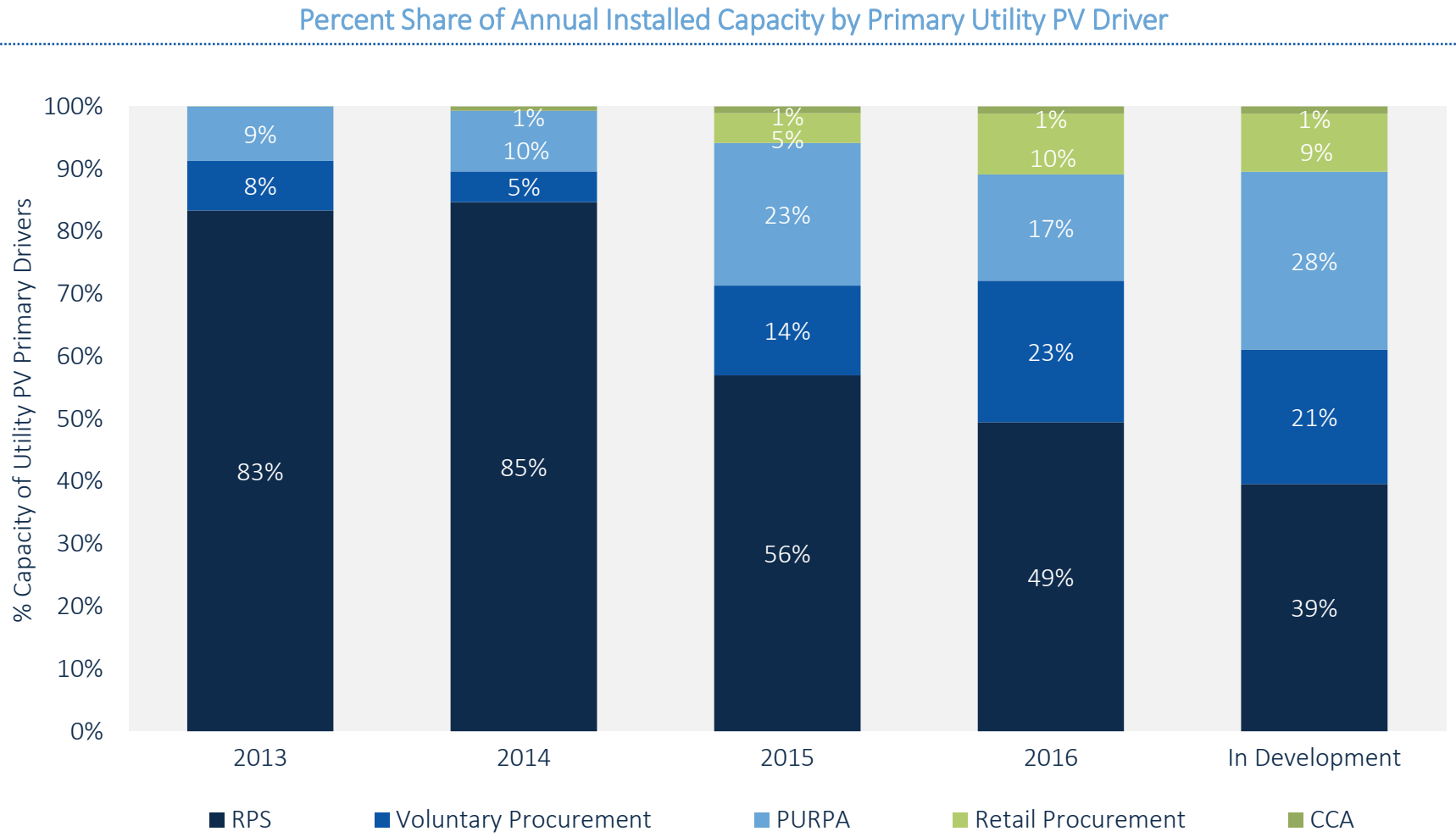
PURPA – The Public Utility Regulatory Policy Act was passed in 1978 to promote energy conservation and renewable energy development. Under PURPA, utilities are required to purchase energy and capacity from qualifying facilities (QFs) at their incremental or avoided costs.

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

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.

Community Choice Aggregation (CCAs) – Several states have enacted policy that enables local government jurisdictions such as towns and counties to aggregate electricity demand and procure alternative energy supplies while still using the transmission and distribution infrastructure of their local utility. Currently 100% of the CCA utility PV pipeline is based in California

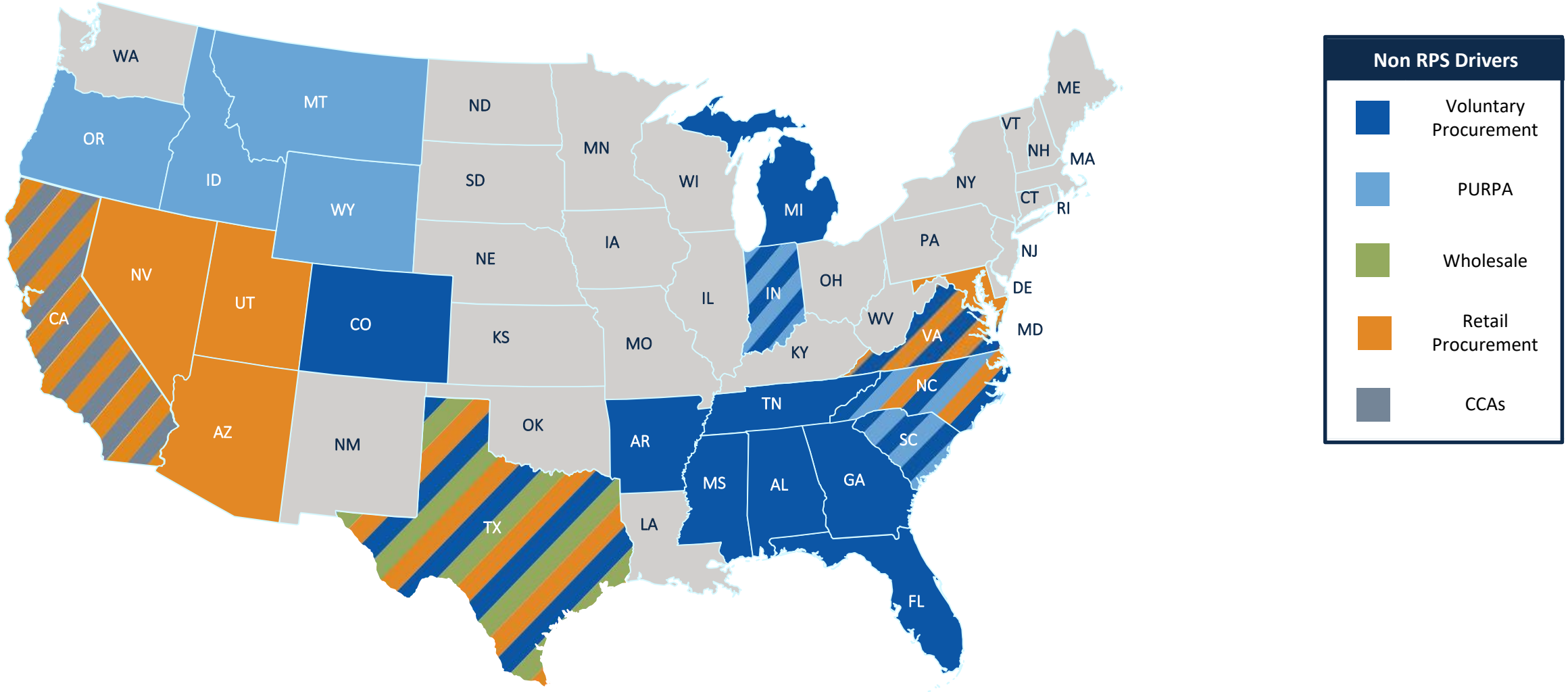
RPS Steps Down as the Primary Driver of Utility PV



Source: U.S. Utility PV Market Tracker

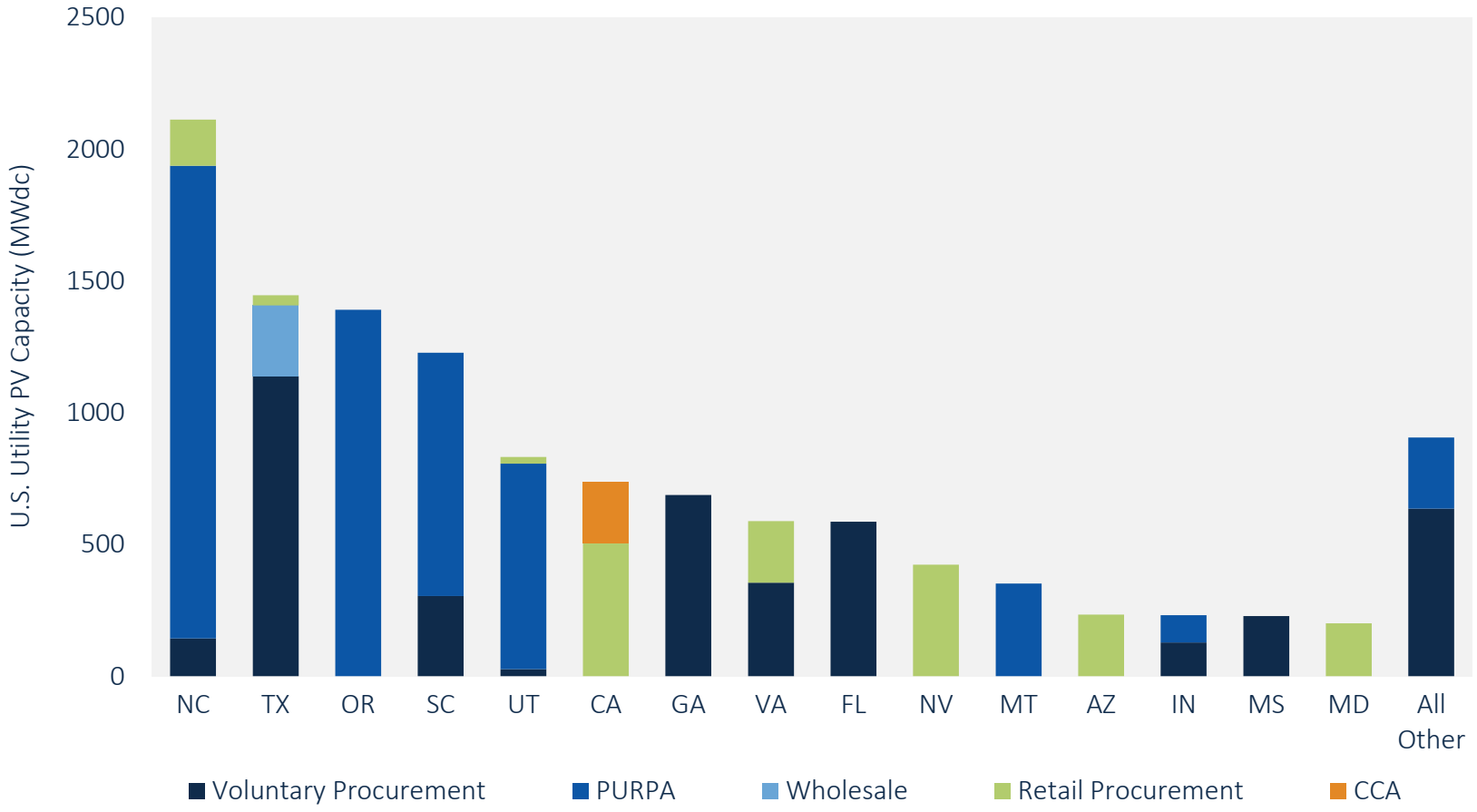
- While renewable portfolio standards will continue to drive a significant volume of new utility PV capacity, non-RPS drivers will spur the majority of new solar development for the next several years
- In 2017, PURPA driven projects in NC, OR, and other states will represent the single largest driver of new capacity additions
- Pacific Gas & Electric and Southern California Edison account for the biggest decline in demand for RPS driven utility PV. In 2015 and 2016, the two utilities accounted for 52% of all RPS driven demand in the US and are not facing net shorts in RPS demand until 2021 or later

States With >50 MW Contracted, Non RPS Utility PV Pipeline as of Nov 2016



Top States for All non-RPS Projects

Top State Markets for Utility PV Projects Outside of RPS Obligations in Development

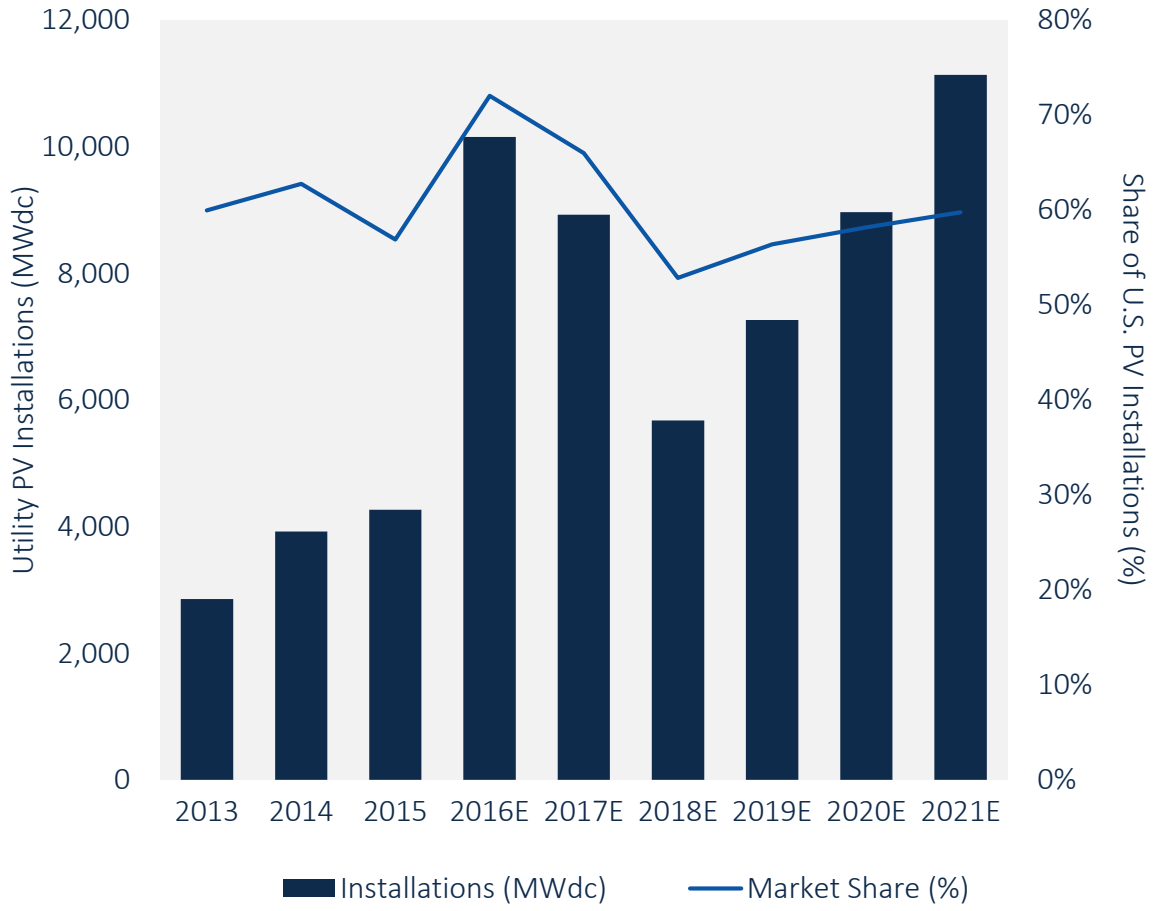


Source: U.S. Utility PV Market Tracker

- The top 5 states (NC, TX, OR, SC, UT) represent 58% of non-RPS utility scale solar in development.
- **PURPA**: Duke Energy is seeking approval from the NC-Utility Commission to make developers competitively bid to develop PURPA projects and limit PURPA growth.
- **Voluntary Procurement**: 92% is concentrated in the southeast, primarily in states with no RPS.
- **Retail Procurement**: With direct access legislation in place, CA represents 36% of retail procurement. NV represents another 20%. Retail procurement has grown rapidly in VA and several developers have announced they are looking for corporate offtakers in VA or PJM territory.

Utility PV Market Outlook: 2016-2021

U.S. Utility PV Installation Forecast: 2013-2021E



Source: U.S. Utility PV Market Tracker

Near Term (2017-2018) and Long Term (2018-2021) Market Outlook

Near Term: 2016 Boom and Spillover Into 2017

- 2016 is on track to have a record 10.15 GW of utility PV come online with an upside risk of some 2017 projects beating expectations and coming online before the end of the year.
- In 2017, 60% of capacity will come from projects that have spilled over from 2016 while project origination and pipeline replenishment diminishes

Long Term: Utility PV Market Reset

- 2018 is a "reset year" that will translate into growth for 2019 and onward.
- PURPA and voluntary procurement will continue to represent a large share of annual utility PV installations while corporate procurement and community choice aggregators will represent a growing portion of new capacity additions.

Future of the Clean Power Plan (CPP)

- The CPP is not included in our base case forecast since the incoming presidential administration has stated they plan to role back implementation of the CPP.

5. Five Things to Keep in Mind in 2017

5 Things to Keep in Mind for 2017

1. **California accounted for 42% of the residential market in Q3 – it's lowest share since 2012**

2. **Emerging state markets are seeing unprecedented growth, but we remain cautiously optimistic due to the susceptibility of incentive markets to boom-and-bust cycles**

3. **Changes to net metering will continue to be a threat to DG economics in emerging and major states alike**

4. **The future is bright for community solar with 2016 seeing the first signs of project completion - looking forward we expect a growing portion of non-residential to be driven by community solar**

5. **The cost competitiveness of utility PV will continue to drive growth through the remainder of 2016 and 2017 as non-RPS drivers become a larger share of the pipeline**